1 TH SEMESTER

Differential and Integral Calculus | ECTS (3+2) 7

Functions, limits, continuity and derivatives. Applications. Extreme values, the Mean Value Theorem and its applications. Graphing. The definite integral. Area and volume as integrals. The indefinite integral. Transcendental functions and their derivatives. L`Hospital`s rule. Techniques of integration. Improper integrals. Applications.

1 th Semester Computational Thinking | ECTS (3+2) 8

This course has little or no experience in computer programming using the Python programming language

aims to prepare non-students for computational thinking as well as software development

is a course. In addition to the elements that make up the Python language, programming logic and software

basics of development will also be taught. Lessons are interactive, supported by classroom exercises and

will be processed with the active support of the instructor.

1 th Semester Computer Literacy | ECTS (3+0) 4

Email and IM usage and etiquette; Computer security basics; Mobile and Cloud computing basics; Google apps and services: Docs, Sheets, Slides, Drive, Calendar, Keep, Scholar; Apple apps and services.

2 TH SEMESTER

2 th Semester 3D Game Modeling | ECTS (2+2) 5

In the character modeling course for the game, our students will learn all stages of the production process of the models used in the games. In ZBrush, Maya and Substance painter program, they will be able to produce 3D models for lowpoly character and environmental design for the game.

2 th Semester Applied Linear Algebra | ECTS (3+0) 4

Matrices, determinants and systems of linear equations. Vector spaces, the Euclidian space, inner product spaces, linear transformations. Eigenvalues, diagonalization.

2 th Semester Basic Programming 2 (C,C++) | ECTS (2+3) 8

At the end of this course the students will be able to learn and use the C programming language to design and implement advanced computer programs. Advanced programming with C: storage and control structures, recursion and programming with dynamic data structures. Homeworks are required to run on Unix environment.

Algorithms and Basic Data Structures 2 **| ECTS (1+4) 7**

Classification of data structures, space and time considerations. Linked lists, stacks and queues,priority queues . Array and pointer based implementations.Heaps and Tree structures, binary search trees,balanced AVL and red-black trees. Fundamentals of sorting and searching. Hash-tables and collision handling.Representation of graphs and introduction to graph algorithms.

- **Learn** C++ language and **implement** data structures in C++
- **Understand** basic mechanisms for algorithm analysis and **apply** them for algorithm analysi
- **Understand** comparison based sorting algorithms and **analyze** them.
- **Understand** and **analyze** the functionalities of lists, stacks, queues, trees, hashing, priority queues and graphs
- **Compare** and **assess** lists, stacks, queues, trees, hashing, priority queues and graphs for a given problem.
- **Develop** algorithms involving the use of lists, stacks, queues, trees, hashing, priority queues or graphs

- **Introduction to 3D Modelling | ECTS (3+2) 7**
-
- In 3D data processing, we deal with 3D raw data that is available, which has no structure, no semantic labelling, no high-level geometric primitives and is incomplete, invalid and even conflicting. Objective of this course is to learn how to develop algorithms for processing and analysis of 3D shapes/geometries
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2 th Semester ELECTIVE Data Structures And Algorithms (3+2), 7

This course furthers the exploration of problem solving, abstraction, and algorithmic design. Students apply the object-oriented paradigm of software development, with emphasis upon fundamental concepts of encapsulation, inheritance, and polymorphism. In addition, object structures and class relationships comprise a key portion of the analytical process including the exploration of problem structure and refactoring. Intermediate concepts in software design including GUIs, threads, events, networking, and advanced APIs are also explored. Students are also introduced to data structures, algorithms, exception handling and design patterns that are relevant to the construction of game systems.

3 TH SEMESTER

3 th Semester Computer Animation (Autodesk Maya) | ECTS (3+2) 7

This class, a lab , fosters a critical and research environment where students investigate emerging forms and media technologies to discover new relationships with animation and digital timed footage. Working with cinematic tropes and various animation techniques students explore how to successfully integrate animation into a new kind of poetic relationship. Seeming opposite worlds reach a unique form for a new composite imaging. The act of re-looking allows for a reconsideration with visions that tap into our subconscious storehouse of symbolic thinking. The workshops in this class are designed to give students a place to develop ideas in their beginning stages. Pieces presented in class are encouraged to be short and exercises in understanding the beginning motivations of ideas and where they come from. Areas of exploration include: rephotography, painted film, art and science, media appropriation, multiplane and performance. All forms of animation are accepted.

3 TH SEMESTER

3 th Semester Game Development Pipeline | ECTS (3+1) 6

The course aims to present a historical and technical knowledge in evolution of video games. Major topics related with game development and design will be covered that give the students an insight on this filed and help them select their elective courses more consciously. Design components and processes, recent techniques in game development, widely accepted software and game engines and special topics in the field will be covered in the scope of the course. Having knowledge on these issues will give students the chance to select a specialization area to concentrate on, with awareness on all important concepts of game design and development.

Basic Programming 3 (C#)

Learn C#, a powerful modern language, from scratch. No prior programming experience is necessary.

Become excellent at using the Unity game engine.

Build a solid foundation for game design and game development that will help you build your own games.

Learn how object oriented programming works in practice.

Create playable game projects - good for your portfolio, or just for your own sense of achievement.

Transfer your knowledge from this course to .NET, other languages, and more.

4 TH SEMESTER

4 th Semester Artificial Intelligence in Computer Games | ECTS (3+2) 8

The course presents the theoretical basics of artificial intelligence (AI) and their application to behavior modeling in game development. The first part will introduce common AI architectures, which can be used in game design, and the second part will cover basic AI techniques towards entity behavior modeling.

Project Topics

- Strategy game with attack and defense behavior of two opposing forces
- Hide and escape behavior of a group of tanks against a helicopter attack
- Follow and help behavior
- Dog fight
- Traffic simulation
- Two body (soldier) defense supported forward movement
- Firing with bombs and missiles against a moving target
- Backgammon like game
- Intelligent sensing while moving
- Bird behavior
- A generic AI engine development

Game Engine (Unreal Engine) | ECTS (2+0) 2

Learn game development using version 4.24 of Unreal Engine 4

Build realistic looking environments for games to take place in

Define custom inputs and movements to control characters

Script logic to define gameplay without needing to know how to code

Foundations of Simulations and Games (Unity3D) | ECTS (3+1) 6

Master beginner C# concepts, like variables, "if" statements, and arrays

Detect collisions, receive user input, and create player movements

Create power-ups including triple shots, laser beams, speed boosts, and shields

Apply shaders that transform your game backgrounds

Create enemies with basic AI behavior

Collect and destroy game objects

Implement sound effects, background music, and particle effects

Activate and use Unity's Team Collaboration service

Navigate the Unity Engine and discover unique features like the Asset Store

Deploy your game to over 20 web or mobile platforms

5 TH SEMESTER

Mobile Programming (iOS+Android) | ECTS (3+1) 6

iOS Development for Android Developers provides a through introduction to iOS app development using the wildly popular Swift programming language. With almost 7.5 hours of engaging video lectures and all the project files used in the videos, this course is designed to take students with no

experience in Swift and little experience in Android to accomplished and COMPLETE mobile app developers. Learn a new language and increase your value

Understand and transfer knowledge from Android to iOS development

Become a Complete Mobile App Developer

Develop a library app with a catchy UI that persists data and handles networking requests

Develop a sleek YouTube player app that parses a JSON request gracefully, handles concurrency with REST API requests, and plays your favourite YouTube videos without leaving your app.

DEPERTMANT ELECTIVE 5 TH SEMESTER Software Development on Linux Systems

Students will learn how to package software for release and engage in version maintenance within the FOSS community. Topics such as Linux package management, version control systems, potential license conflicts, development vs. production releases, bug tracking, maintenance management, forking, patching and future development will be covered in from both a management and end-user perspective in lectures, lab exercises and a project.

5 TH SEMESTER Project in FOSS Development

Free and Open Source Software development is an internationally growing methodology for distributing work across multiple developers. The process can be applied to small garage-sized teams (small utility packages, multimedia plugins, simple games) or teams of hundreds (Mozilla, Java, Linux). This course builds on the introductory experience provided in the prerequisite to provide hands-on open-source development experience in a large-scale, project that will be prepared for open-source distribution. The actual projects and domains addressed will vary offering to offering, but will be along the lines of those listed above.

DEPERTMANT ELECTIVE 6 TH SEMESTER Foundations of Game Engine Design and Development

This course will provide students with theory and practical skills in game engine design topic areas such as understanding the graphics pipeline as it influences engine design, hardware principles and the relationship to game engine construction, mathematical principles involved in game engine design, scene graph construction and maintenance, texture and materials management, collision systems, physics systems, particle systems, and control systems. Furthermore, this course will examine software and toolsets that assist game engine designers in their tasks. Students will be expected to design and implement a game engine in teams as well as properly document their design and development strategy.

DEPERTMANT ELECTIVE 6 TH SEMESTER Artificial Intelligence for Game Environments

This course explores introductory artificial intelligence concepts through both a theoretical and practical perspective, with an emphasis on how to apply these concepts in a game development context. In particular the course focuses on applying concepts such as search, reactive intelligence, knowledge representation, and machine learning to real-time situations and applications as relevant to the field of entertainment technology and simulation.

DEPERTMANT ELECTIVE 6 TH SEMESTER IGM Production Studio

This course will allow students to work as domain specialists on teams completing one or more large projects over the course of the semester. The projects will be relevant to experiences of the

interactive games and media programs, but they will require expertise in a variety of sub-domains, including web design and development, social computing, computer game development, multi-user media, human-computer interaction and streaming media. Students will learn to apply concepts of project management and scheduling, production roles and responsibilities, and their domain skill sets to multidisciplinary projects. Students will complete design documents, progress reports and final assessments of themselves and their teammates in addition to completing their assigned responsibilities on the main projects.

DEPERTMANT ELECTIVE 7 th Semester Game Design and Development I
This course examines the core process of game design, from ideation and structured brainstorming in an entertainment technology context through the examination of industry standard processes and techniques for documenting and managing the design process. This course specifically examines techniques for assessing and quantifying the validity of a given design, for managing innovation and creativity in a game development-specific context, and for world and character design. Specific emphasis is placed on both the examination and deconstruction of historical successes and failures, along with presentation of ethical and cultural issues related to the design and development of interactive software and the role of individuals in a team-oriented design methodology. Students in this class are expected to actively participate and engage in the culture of design and critique as it relates to the field.

7 th Semester Machine Learning | ECTS (3+2) 7
This course provides a broad introduction to machine learning. The topics include supervised and unsupervised learning, Bayesion inference/classification, regression, clustering, kernels and Support Vector Machines (SVM) and accompanying concepts such as model and feature selection, combining classifiers such as boosting, active learning, dimension reduction techniques.

DEPERTMANT ELECTIVE 7 th Semester Mobile Application Development I

This course extends the material covered in the Foundations of Mobile Design course and provides students with the experience of creating interesting applications for small-size form factor mobile devices such as smartphones These devices are exceptionally portable, have unique sets of hardware and communications capabilities, incorporate novel interfaces, are location aware, and provide persistent connectivity. Students are encouraged to make creative use of these unique device characteristics and operating properties to develop innovative applications. Programming projects are required.

8 th Semester Game Production
This course will allow students to work as domain specialists on teams completing one or more large projects over the course of the semester. The projects will be relevant to experiences of the interactive games and media programs, but will require expertise in a variety of sub-domains, including web design and development, social computing, computer game development, multi-user media, human-computer interaction and streaming media. Students will learn to apply concepts of project management and scheduling, production roles and responsibilities, and their domain skill sets to multidisciplinary projects. Students will complete design documents, progress reports and final

assessments of themselves and their teammates in addition to completing their assigned responsibilities on the main projects.

DEPERTMANT ELECTIVE 8 th Semester Game Design and Development 2
This course continues to examine the core theories of game design as they relate to the professional field. Beginning with a formalized pitch process, this course examines the design and development paradigm from story-boarding and pre-visualization through rapid iteration, refinement, and structured prototyping exercises to further examine the validity of a given design. Specific emphasis is placed on iterative prototyping models, and on methodologies for both informal and formal critique. This course also explores production techniques and life-cycle in the professional industry.

8 th Semester Graduate Seminar This is intended to allow for special one-time offerings of graduate topics. Specific course details (such as the course topics, format, resource needs, and credit hours) will be determined by the faculty member(s) who propose a given seminar offering. (Varies)

DEPERTMANT ELECTIVE Mobile Application Development II

This course extends the Foundations of Mobile Design course in that students will learn to apply mobile design skills to develop applications in the Android platform. Students will design, develop, and test mobile applications using the Android Studio IDE. This course covers the major components such as activities, receivers, content providers, permissions, intents, fragments, data storage, and security. Programming projects are required

DEPARTMENT ELECTIVE COURSE DESCRIPTIONS

Multi-platform Media App Development

Interactive media applications are no longer restricted to personal computers. They can now be found on many distinct hardware platforms including mobile, tablet, wearable, and large-screened computing devices. In this course, students will learn to design, prototype and develop media rich interactive experiences that can be deployed to a wide variety of hardware devices. Programming projects are required.

Level Design

This course introduces level design theory and best practice through game level analysis, evaluation, and creation. Students will learn by analyzing game levels from existing games and discussing what made those levels successful or unsuccessful. Through their analysis and hands on experience, students will gain an understanding of overall level design including layout, flow, pacing, and balance. They will enhance their understanding of level design principles by creating their own game levels.

Tabletop Game Design and Development

This course explores issues pertaining to design, mechanics, development, and production of analog, tabletop hobby games, which include board games, card games, wargames, and other non-digital games catering to multiple players. Students will analyze and apply concepts and mechanics of modern tabletop game design, and build and test tabletop games. Students will work with development and prototyping tools, explore component design and art direction, and work with desktop publishing technologies. In addition, they will work directly with board game publishing and manufacturing technologies and services, and study factors pertaining to the business of tabletop games.

Games for Change

This course provides students with the opportunity to explore games and simulations for social change and learning. Students will explore various research, design, and development techniques for applying games to addressing issues and problems in communities, from local to global. Students will learn to design and develop games and simulations as well as how to gather and analyze data about the games' usage. Topics may include issues-based organizing and advocacy, place-based learning, and games for civics. In addition, students are exposed to current debates in the field of Games for Change.

Rich Media Web Application Development II

This course provides students the opportunity to continue the exploration of Media Rich Internet Applications (MRIAs). Topics include communications for media ecologies, distributed web application frameworks, advanced interactivity, data transformation, representation, automation, persistence, and large scale systems deployment. In addition, students are exposed to concepts and technologies related to the next generation of MRIA development.

Online Virtual Worlds and Simulations

Students will create online virtual worlds and simulations using 3D development technologies. Critical to the exploration of this area, students will learn to utilize 3D constructs for the presentation of and interaction with interactive content and dynamic experiences. The course allows students to integrate prior knowledge in design, programming, and interaction for the creation of such experiences. Individual and group projects will be required.

Casual Game Development

This course explores the design and construction of casual game experiences. Topics include modes of casual game play, mechanics for casual games, characteristics of successful games, development processes, and the distribution of casual games. Students will create casual games, and employ

technologies to address issues of scalability, presentation, social interconnectivity, and game analytics.

Systems Concepts for Games and Media

This course focuses on systems-based theoretical models of computation in the context of a media-delivery modality. Students will explore concepts such as memory management, parallel processing, platform limitations, storage, scheduling, system I/O, and optimization from a media-centric perspective. Particular emphasis will be placed on the integration of these concepts in relation to industry standard hardware including game consoles, mobile devices, custom input hardware, etc.

Data Visualization

Our world is flooded with data, and making sense of it can be a challenge. Visualizations help by exposing information, trends, and correlations that might otherwise go unnoticed in the raw data. In this course, students will learn to collect, clean, organize, and filter data sets of their own choosing. They will learn and apply principles from multiple fields including visual design, the psychology of perception, user experience design, and ethics. They will create static and interactive visualizations with a variety of information structures (hierarchies, maps, timelines, etc.). Students will learn to develop exploratory experiences that tell the story within the data. Programming projects are required.

Physical Computing and Alternative Interfaces

The rich variety and widespread adoption of gestural touch screens, motion-sensing devices, weight-reactive surfaces, wearable digital devices, and similar interface products demonstrates the demand for well-integrated devices and services that seamlessly couple people and environments. Such products can interface computers with real-world inputs and outputs, and give people new ways of controlling and experiencing their devices and information. This course provides a rapid technical introduction to basic electronics (components, circuits, microcontrollers, etc.) and emphasizes the application of interface design concepts to physically interactive and innovative product development. The course requires solo and team projects that blend electronics, programming, and design.

Current Topics in Interactive Development

Interactive media development is a rapidly evolving field. This course provides an opportunity for students to learn and experiment with emerging themes, practices, and technologies that are not addressed elsewhere in the curriculum. Topics covered in this course will vary based on current developments in the field. Students will explore, design, and develop creative interactive experiences pertaining to the semester's domain area. Programming projects are required.

Foundations of Interactive Narrative

This course focuses on the major elements of narrative for interactive environments. Students in this course explore the basics of narrative in the context of interactive games and media, with examination of digital storytelling in games and interactive environments of several varieties. Branching narrative, hypertext, multi- and non-linear concepts are also explored with an emphasis on balancing immersive and interactive aspects of digital narrative.

Aesthetics and Computation

Students will design and build creative applications, while studying the history of computation in the visual arts, music, and other relevant areas. Technical topics include advanced audiovisual programming techniques, while theoretical topics include foundational discussions on artificial life, generative art, microsound, participatory and process-based art, programming as performance, and computational creativity. Individual and/or group projects will be required.

Foundations of Game Graphics Programming

Students will explore the use of an advanced graphics API to access hardware-accelerated graphics in a real-time graphics engine context. The course will involve discussion of scene graphs, optimizations, and integration with the API object structure, as well as input schemes, content pipelines, and 2D and 3D rendering techniques. Students will also explore the advanced use of the API calls in production code to construct environments capable of real-time performance. Students will construct from scratch a fully functional graphics engine, with library construction for game development.

Digital Audio Production

Technologies and techniques for producing and manipulating digital audio are explored. Topics include digital representations of sound, digital audio recording and production, MIDI, synthesis techniques, real-time performance issues, and the application of digital audio to multimedia and Web production.

Interactive Game and Audio

This course provides students with exposure to the design, creation and production of audio in interactive applications and computer games. Students will become familiar with the use of sound libraries, recording sounds in the studio and in the field, generating sound with synthesizers, and effects processing. Students will create sound designs for interactive media, integrating music, dialog, ambient sound, sound effects and interface sounds within interactive programs.

IGM Production Studio

This course will allow students to work as domain specialists on teams completing one or more large projects over the course of the semester. The projects will be relevant to experiences of the interactive games and media programs, but will require expertise in a variety of sub-domains, including web design and development, social computing, computer game development, multi-user media, human-computer interaction and streaming media. Students will learn to apply concepts of project management and scheduling, production roles and responsibilities, and their domain skill sets to multidisciplinary projects. Students will complete design documents, progress reports and final assessments of themselves and their teammates in addition to completing their assigned responsibilities on the main projects.

Innovation and Invention

In this course, students explore the process and products of innovation and invention. Each semester a multi-disciplinary team of students conceives and develops a different outside the box project. Readings, projects, scholarly term papers, and pragmatic challenges of collaboration and communication across disciplines provides direct experience of the interplay of technology, human nature, and a human environment in which emerging technologies and new modes of interaction are pervasive and ubiquitous. Artists, natural scientists, social scientists, and technologists are guided through a series of collaborative experiences inventing, designing, implementing and studying emerging technologies. Presentations, projects and individually-written research papers are required. The faculty staff and resources of the Center for Student Innovation are significant assets for this course.

Humanitarian Free and Open Source Software Development

This course provides students with exposure to the design, creation and production of Open Source Software projects. Students will be introduced to the historic intersections of technology and intellectual property rights and will become familiar with Open Source development processes, tools and practices. They will become contributing members of humanitarian software development communities such as the One Laptop Per Child and Sugar communities. Students will actively document their efforts on Humanitarian Free and Open Source Software community hubs.

Legal/Business Aspects of FOSS

The entertainment and software industries are grappling with the impacts of free software digital distribution. Agile development, 3D printing, the Internet and other technologies are changing the face of how business is done, as well as what business can charge for and hold onto. Disruptive technologies, emerging interfaces, and real-time, on-demand product creation and distribution are transforming our entertainment, telecommunications and manufacturing landscapes. This course will examine the impacts of these new technologies and the new thinking that are taking us into these new worlds.

New Media Team Project

This course is designed to engage the new media major in a capstone production experience. The instructor will form interdisciplinary student teams that will design, plan, prototype, and implement new media projects. Student groups are required to test their product with users and provide written feedback and analysis.

Research Studio

This course will allow students to work as domain specialists on teams completing one or more faculty research projects over the course of the semester. The faculty member teaching the class will provide the research topic(s). Students will learn about research methodology to implement, test, and evaluate results of projects. Students will complete research reports and final assessments of themselves and their teammates in addition to completing their assigned responsibilities on the main projects.

Undergraduate Seminar in IGM

This is intended to allow for special one-time offerings of undergraduate topics or to allow faculty to pilot new undergraduate offerings. Specific course details (such as the course topics, format, resource needs, and credit hours) will be determined by the faculty member(s) who propose a given special-topics offering.

Independent Study

The student will work independently under the supervision of a faculty advisor on a topic not covered in other courses.

Board and Card Game Design and Development

This course explores issues pertaining to design, mechanics, development, and production of analog, tabletop "hobby" games, which include board games, card games, wargames, and other non-digital games catering to multiple players. Students will analyze and apply concepts and mechanics of modern tabletop game design, and build and test both competitive and cooperative tabletop games, designed specifically for a global audience. Students will work with development and prototyping tools, explore component design and art direction, and work with desktop publishing technologies. In addition, they will work directly with board game publishing and manufacturing technologies and services, and study factors pertaining to the business of tabletop games, and produce a professional, polished tabletop game.

Game Balance

This course is an in-depth exploration of the sub-field of game design known as balance. Topics include: transitive mechanics and cost/power curves; economic systems in games; probability and the psychology of randomness; pseudorandom numbers; situational balance; level/XP curves, advancement and pacing; tuning; statistics, metrics, and analytics; intransitive mechanics, game theory, and payoff matrices; and the applied use of spreadsheets.

Tabletop Role-Playing Game Design and Development

This course explores the concepts and mechanics of analog role-playing games, such as tabletop "pencil-and-paper" and live-action role-playing games, from a practical, hands-on perspective. In this project-based course, students will develop their own rule systems to facilitate various facets of role-playing and associated game mechanics, then playtest and publish their games. Students will also use desktop publishing tools to produce game rules and supplemental materials suitable for publication. Note that this course assumes that students have extensive experience in playing tabletop role-playing games.

Digital Audio Production

Technologies and techniques for producing and manipulating digital audio are explored. Topics include digital representations of sound, digital audio recording and production, MIDI, synthesis techniques, real-time performance issues, and the application of digital audio to multimedia and Web production.

Interactive Game and Audio

This course provides students with exposure to the design, creation and production of audio in interactive applications and computer games. Students will become familiar with the use of sound libraries, recording sounds in the studio and in the field, generating sound with synthesizers, and effects processing. Students will create sound designs for interactive media, integrating music, dialog, ambient sound, sound effects and interface sounds within interactive programs.

Innovation and Invention

In this course, students explore the process and products of innovation and invention. Each semester we conceive and develop a different outside the box project in a multidisciplinary tinkerer's lab. Readings, lectures, student presentations, and discussions deal with the interplay of technology, human nature, and a human environment in which emerging technologies and new modes of interaction are pervasive and ubiquitous. Students from multiple disciplines are guided through a series of collaborative experiences inventing, designing, implementing and studying emerging technologies and their educational and artistic potential. Presentations, projects and individual research papers are required.