

GAME DEVELOPMENT (GAM)

GAM 102 | MECHANICS OF GAME DESIGN | 4 quarter hours (Undergraduate)

This course introduces students to the design and implementation of core mechanics and game loops for real-time digital games. In order to hone an eye for detail and a deeper understanding of how design decisions ripple out across different systems, this class focusses on a single game genre, such as 2D platforming games, walking simulators, or stealth games. Students will play several games from that genre, analyze their affordances, and develop prototypes of specific subsystems.

Topics to be covered include genre history, game feel, interaction design, procedural rhetoric, systems design, common scripting patterns.

GAM 240 is a prerequisite for this class.

GAM 180 | UNREAL ENGINE WORKSHOP | 2-2.25 quarter hours (Undergraduate)

This course focuses on teaching students the fundamentals to Unreal Engine. By the end of the course the students will build a small game from scratch in the Unreal Engine. No programming knowledge is required to take this course. Students will learn basic concepts of the Unreal Engine, from learning the interface of UE4 to scripting basic behaviors with blueprints. Students will also learn the basics of several different modules in UE4.

GAM 181 | UNITY WORKSHOP | 2-2.25 quarter hours (Undergraduate)

This course focuses on teaching students the fundamentals of Unity. By the end of the course the students will build a small game from scratch in the Unity. No programming knowledge is required to take this course. Students will learn basic concepts of the Unity Game Engine from learning the interface of Unity to scripting basic behaviors in C#. Students will also learn the basics of several different modules in Unity Engine.

GAM 200 | PLAY | 4 quarter hours (Undergraduate)

Exploring the concept of "play" from a variety of disciplinary perspectives including sociology, anthropology, psychology, literary and theater studies and the arts, this course discusses "play" as a central force in cultural, social, artistic and personal development. It intends to raise awareness for the ways in which "play" can promote creativity, mental and emotional health, problem solving as well as personal and social change. It analyzes the role of "play" as an element of negotiation and reconciliation between disparate forces within the individual and with others.

GAM 201 | HISTORY OF VIDEOGAMES | 4 quarter hours (Undergraduate)

This course provides an overview of the history of modern interactive entertainment starting with the early developments of the late 1940s up until the present day. The course covers five longitudinal perspectives, or themes. For each theme students will become familiar with notable game titles, events, people, technologies, game mechanics and genres.

GAM 205 | GAMES LITERACY | 4 quarter hours (Undergraduate)

This lecture course introduces students to the evolving forms, uses, and design of games. Topics covered include the relationship between game design and play, the role of games in fueling the technological imagination, the changing contexts in which games are designed and played (art, social impact, health, education), and the rise of the independent games sector. Students will produce weekly written responses to course material, lead a seminar discussion in small teams, and produce a final written or multimedia paper. PREREQUISITE(S): None.

GAM 206 | HISTORY OF GAMES | 4 quarter hours (Undergraduate)

From "The Royal Game of Ur" (2500+ BCE) to "World of Warcraft" (2004), games have been a constant in human history. The forms of games, their experiential qualities, and their cultural significance have varied enormously from era to era and place to place. This class will examine particular games and game genres in their historical context using a case study format. We will focus on "indoor" games, those of chance and skill, as opposed to physical games and sports. The examples will be chosen (i) to have global scope and historic diversity, (ii) to relate to games that students will find familiar, and (iii) to raise particular issues in historical interpretation, the use of primary sources and changing concepts of leisure activity.

GAM 208 | VIRTUAL WORLDS AND ONLINE COMMUNITIES | 4 quarter hours (Undergraduate)

Environments such as social networking sites, multiplayer online games and other online communities are becoming an increasingly large part of how we work, play, and learn. This course introduces the fundamentals for the interdisciplinary study of cyberculture and online social behavior. By examining core scholarship in this area, together with analyzing an existing virtual world, game, or online community, students will learn to research and understand new technologically-enabled social forms as they are emerging.

WRD 104 is a prerequisite for this class.

GAM 210 | SURVEY OF GAME ENGINES | 4 quarter hours (Undergraduate)

Students will explore the foundations of game engine technology, such as industry-leading platforms Unreal Engine and Unity. This introductory course is designed for those new to game development and will guide students through the core tools, workflows, and principles necessary to bring digital worlds to life. Using hands-on, real-world examples, students will gain familiarity with essential concepts such as level design, asset integration, basic scripting, and visual effects. By the end of the course, students will be able to navigate a game engine environment confidently and will have the skills to begin creating their own interactive experiences.

GAM 224 | GAME DESIGN FOR NON-MAJORS | 4 quarter hours (Undergraduate)

This course approaches the study of computer games from three angles: first, as examples of media that can be analyzed and critiqued for their thematic elements, formal structure, plot and interactive appreciation; second, as complex software artifacts subject to technological constraints and the product of a labor-intensive design and implementation process; and three as a cultural artifact with behaviors and associations comparable in import to other popular art forms. Students will study the principles of game design and use them both to analyze existing games and to develop their own original game ideas. Students will also learn about the process of game development, starting from the game's narrative concept and moving to consideration of a game's components: the representation of the player, of artifacts, the virtual world that contains them and the interaction between them and the player.

GAM 226 | FUNDAMENTALS OF GAME DESIGN | 4 quarter hours (Undergraduate)

This course provides students a practical foundation in game design with a focus on concept development, design decomposition, and prototyping. Using game design theory, analysis, physical prototyping, playtesting, and iteration students learn how to translate game ideas, themes, and metaphors into gameplay, game pitches, and design documents. Students will analyze and recognize play that exists in important games, stories, and other media.

GAM 228 | ETHICS IN COMPUTER GAMES AND CINEMA | 4 quarter hours (Undergraduate)

Societies function based on normative ethics utilizing common sense to distinguish between ethical and unethical behavior. Most of us are not aware of the underlying theories when arriving at ethical judgments about right and wrong. However, the fast pace of progress in information technologies and digital entertainment creates an environment in which ethical challenges are particularly complex. In the eyes of many, games and movies are violent, offensive and immoral. This course will concentrate on analyzing the impact of digital entertainment on an individual and society. Implications of certain values embedded in games and movies will be discussed. Elements of the ethical code of conduct for a game or movie creator will be formulated. The issue of balancing individual creativity vs. cultural impact, particularly on children, will be discussed.

GAM 230 | INTRO TO GAME PRODUCTION | 4 quarter hours (Undergraduate)

Game development is a big business, and production teams can now exceed one hundred people. This course is an introduction to the production methods used in the game industry, and to the demanding role of the Producer on the game development team. Students will work to develop skills in team building, project presentation, organization, and dealing with people. Subjects covered include scheduling tools, collaborative software, project management, vendor relations, inter-departmental relations, and quality assurance.

GAM 245 is a prerequisite for this class.

GAM 231 | HISTORY AND DESIGN OF ROLE-PLAYING GAMES | 4 quarter hours (Undergraduate)

Students learn the history of role-playing games and the process of world-building to collaboratively design and develop their own games that advance the genre. Topics include the psychological and social opportunities unique to the genre, as well as its history from table-top, to live-action and massively multi-player. Class time consists of lectures, workdays, workshops, playtests, and critiques.

GAM 224 or GAM 226 is a prerequisite for this class

GAM 240 | PLAYGRAMMING | 4 quarter hours (Undergraduate)

This workshop introduces computer programming to artists and game designers. Programming is an art, but before students can create masterpieces they first need to explore, play, and sketch with code. Students learn basic concepts and techniques of computation and apply these to craft gameplay experiences, improvisational experiments, and software toys. Students will author code from scratch and remix code to complete their weekly projects. No prior programming experience or knowledge is required. PREREQUISITE(S): None.

GAM 244 | GAME DEVELOPMENT I | 4 quarter hours (Undergraduate)

Students will follow the game production cycle as solo developers from initial concept development to prototyping, implementation, playtesting and publishing of a small but polished and complete 2D game experience as a portfolio piece. Class sessions will provide additional theory on game design and development concepts as well as guidance on how to practically apply them. Students will be introduced to version control systems in a game development context. Students are expected to have a good understanding of skills learned in earlier foundational courses and are required to meaningfully engage in peer critiques and self-reflections. **(GAM 224 or GAM 226) and {(GAM 210 or GAM 181) and GAM 240} or ANI 201} are prerequisites for this class.**

GAM 250 | SOUND DESIGN FOR GAMES I | 4 quarter hours (Undergraduate)

This course is an introduction to the principles of digital audio and the methods employed to create, edit, and deliver sound for video games. The course examines the place of sound in video games, both artistic and technological. The course will cover the basics of sound in the physical and digital realm, sound effects editing, and sound effects delivery. Lectures, discussions, and videos will be used to examine the art and the process of adding sound to video games. Students will learn to edit sound assignments with Pro Tools and other current technologies.

GAM 312 | PLAYTESTING | 4 quarter hours (Undergraduate)

In this course, students will learn how to identify design goals, form hypothesis about their designs, develop good research and interview questions, plan and conduct playtests, as well as how to evaluate playtest data so it can inform design iterations and help to make better games.

GAM 226 is a prerequisite for this class.

GAM 315 | SOUND DESIGN FOR GAMES II | 4 quarter hours (Undergraduate)

This course expands on topics covered in GAM 250. Students will further their knowledge of recording techniques for voiceover, sound effects, and music; editing voiceover and music; and mixing. The course will also introduce audio implementation using Unity. Coursework will utilize the recording studio extensively for in-class and out-of-class work. The course is intended for advanced students who wish to develop their skills and gain more experience in preparing and mixing sound design for video games.

GAM 250 or POST 124 is a prerequisite for this class.

GAM 316 | MUSIC FOR GAMES | 4 quarter hours (Undergraduate)

Students are introduced to elements of music and ways in which these elements may be used to create a musical style that enhances video games. The course emphasizes understanding the function of the score and how it relates to texture, color, and drama in music. Students explore their creativity using the tools available, work on projects of increasing complexity, and complete a score for their own video game as a final project. Listening skills, music vocabulary, and business and legal aspects of the profession are also studied.

GAM 250 or POST 124 is a prerequisite for this class.

GAM 317 | GAME SOUND DESIGN AND SCORING STUDIO | 4 quarter hours (Undergraduate)

This course is intended to provide practical experience in audio production for video games, as well as to offer the opportunity to create quality materials to include in a demo reel or portfolio. It will build on the background and skills acquired in Game Sound Design 1 and Game Sound Design 2. Students will study the sound designs of different genres of video games, and then complete five projects in which they will be creating the sound designs for games of those genres. A key element of this course will be in-class discussions and critiques of students' work, both to sharpen their sound designing and critical listening skills.

GAM 325 | APPLIED 3D GEOMETRY | 4 quarter hours (Undergraduate)

Review of mathematical foundation and techniques needed for the development of 3D graphics and game systems. This class will provide the foundation in linear algebra and 3D geometry required for implementing common tasks in 3D graphics and game systems. Topics include: vectors, matrices, transforms, coordinate changes, projections, intersection.

CSC 301 is a prerequisite for this class.

GAM 326 | GAMES WITH A PURPOSE PRE-PRODUCTION | 4 quarter hours (Undergraduate)

Students will explore a variety of Games With A Purpose (GWAP) - games designed with goals beyond entertainment - targeting areas such as health, education, social and personal transformation, civics, and activism. Students will gain a theoretical foundation for understanding games as expressive and persuasive media with the power to drive real-world change, including frameworks used to uniquely design and conduct assessment of GWAPs.

GAM 224 or GAM 226 is a prerequisite for this class

GAM 329 | PHYSICAL PROTOTYPING FOR GAMES | 4 quarter hours (Undergraduate)

This course will approach the study of Game Design with a focus on breaking designs into manageable elements and prototyping those elements in order to refine play. Students will learn how to develop game ideas and game systems with a focus on play procedures, rules, and designing for various types of possible players. Prototyping will involve various real world media in addition to paper write-ups and layouts. Students will engage in brainstorming exercises, develop game ideas and systems, and review and repurpose existing game mechanics. This course will help students find the balance between hard (planned logical) design and soft (more organic/emergent) design in order to develop compelling gameplay.

GAM 226 or GAM 224 is a prerequisite for this course

GAM 330 | ADVANCED GAME PRODUCTION | 4 quarter hours (Undergraduate)

This course builds on the fundamentals covered in earlier courses (GAM230 or IS372/ECT372) by providing a practical, hands-on context in which students can learn the tools and techniques game producers use to manage and organize assets, workflows, tasks, bugs, resources, and personnel. In this course, students combine classroom lectures and lab time to learn production theory, tools, and techniques fundamental to successful game development. Through this experience, students learn the skills and knowledge needed to have an immediate, positive impact on game development. Topics include: the process to refine ideas for game concepts, gameplay, and narrative; quality assurance of subjective elements including gameplay and art; design and art outsourcing pipelines; and feedback strategies and community management.

GAM 230 or IS 372 or ECT 372 is a prerequisite for this class

GAM 333 | THE BUSINESS OF GAMES | 4 quarter hours (Undergraduate)

This course gives an introduction to the business aspects of the game development industry, including development, publishing, distribution and marketing. Subjects covered include game development contracts, milestone-based development, management techniques, marketing, customer and community support, personnel, budgeting, outsourcing, pipelines, and external partnerships.

GAM 334 | THE BUSINESS OF INDIE GAMES | 4 quarter hours (Undergraduate)

This class will explore how to successfully run an indie game company using an arsenal of best practices. Topics include how to write a game design document for marketability and a business plan for an indie studio, as well as how to build and maintain relationships with the media. Students will also gain an understanding of how indie games fit into the game industry as a whole.

GAM 335 | GAME ENGINES FOR CINEMATIC EFFECTS AND VIRTUAL PRODUCTION | 4 quarter hours (Undergraduate)

This course focuses on teaching both filmmakers, designers and artists the fundamentals of a game engine. Topics include how to develop or import materials, environment pieces, animations, as well as creating lighting, post processing and cinematics. Emphasis will be placed on creating 3D set pieces and cinematic sequences. No previous experience with 3D is required.

GAM 340 | PRACTICAL SCRIPTING FOR GAMES | 4 quarter hours (Undergraduate)

This workshop introduces game scripting to artists and game designers. A game script is a short list of commands that control something in a game, such as how a character moves, or an enemy's behavior. Students will learn to read, modify, and author scripts that generate and affect a variety of game elements over the course of weekly projects.

GAM 245 or CSC 241 or CSC 242 or CSC 243 is a prerequisite for this class.

GAM 341 | INTRODUCTION TO LEVEL DESIGN | 4 quarter hours (Undergraduate)

Level design is the art of creating believable environments, stages and missions for video games. This course explores topics including architecture, flow, pacing and puzzles. Using a 3D level editor, students will investigate technical design issues including the construction, texturing, lighting and scripting of modern game levels. The roles, duties and challenges of the level designer will also be discussed.

GAM 245 is a prerequisite for this class.

GAM 342 | ADVANCED LEVEL DESIGN | 4 quarter hours (Undergraduate)

This class builds on topics covered in earlier courses, with a focus on creating believable worlds for videogames. This course emphasizes designing large exterior environments, advanced mission scripting, and integrated storytelling. Using a 3D level editor and formal level design process, students create fun, polished, memorable virtual worlds.

GAM 341 or GAM 392 is a prerequisite for this class

GAM 344 | GAME DEVELOPMENT II (FORMERLY GAM 245) | 4 quarter hours**(Undergraduate)**

Students will develop skills in game design and development through the creation of a digital game based on a set of constraints. These constraints may be theme, mechanics, client-based, or similar restrictions on the project. Emphasis will be placed on teamwork and development pipelines for the design and creation of assets and systems. Students will use a combination of prototyping, storyboarding, user stories, character breakdowns, system breakdowns and flowcharts in the design portion of the game. The goals of all design done in this course will focus around designing for particular needs; solving problems identified through the restrictions; and providing transparency via reports and milestone deliverables.

(GAM 244 and GAM 230 and GAM 340 and GAM 341) OR (CSC 241 or CSC 243) OR (GAM 244 and GAM 341 and ANI 240 and ANI 344) are prerequisites for this class.

GAM 350 | PHYSICS FOR GAME DEVELOPERS | 4 quarter hours**(Undergraduate)**

The course concentrates on Newton's Laws of Motion, kinematics and kinetics. This theory will be applied to problems that a game programmer must understand e.g. collisions between objects, projectiles and their trajectories, real-time simulation of motion. Special objects such as cars, aircraft and ships will be discussed. Students will apply and implement laws of physics.

GAM 372 or (SE 350 and CSC 361) are prerequisites for this class.

GAM 351 | EXPRESSIVE AUDIO SCRIPTING IN GAMES | 4 quarter hours**(Undergraduate)**

This workshop is for game designers, sound designers and programmers to learn how to creatively use audio in game engines. Students develop skills to effectively shape and manipulate game audio to achieve intended dramatic experiences. Topics include key terms and techniques, industry trends in game audio implementation, and how to advance the medium of games through audio. Students listen and critique each other's work, learning to assess game audio in terms of narrative, aesthetics and quality.

GAM 353 | TOOL PROGRAMMING FOR GAME DEVELOPMENT | 4 quarter hours**(Undergraduate)**

This course focuses on the parsing and conditioning of game related assets for real-time game engines. Topics include the content pipeline, processing or standard file formats using modern API, integration of external tools, run-time file format design, command line and graphical user interfaces.

GAM 372 or (SE 350 and CSC 361) are prerequisites for this class.

GAM 355 | SOLO GAME DEVELOPMENT PROJECT | 4 quarter hours**(Undergraduate)**

Students will independently create a brief but fully realized interactive experience, focusing on a specialized area of their choice. Through a compressed development cycle, students will bring an appropriately scoped, polished project from concept to completion. By brainstorming an innovative idea, prototyping rapidly, and iterating on core gameplay loops and game feel, students will refine essential skills for game design. Each student will focus on a specific aspect of development, such as designing experiential flow, programming gameplay behaviors, or creating digital worlds or characters that enrich the overall experience.

(GAM 344 and Junior Standing) are prerequisites for this class.

GAM 362 | MAKING DEEP GAMES | 4 quarter hours**(Undergraduate)**

This workshop investigates the process of designing games about the human condition. It specifically focuses on the potential of games to tackle profound and abstract ideas (e.g. loyalty, dignity, courage and trust) by way of metaphor and analogy. Assignments will explore metaphorical games, games for persuasion and games for self-expression. Special emphasis is placed on the analysis of personal experiences and how they can be translated systematically into game designs that generate non-typical gameplay content.

GAM 226 or GAM 224 is a prerequisite for this course

GAM 365 | ADVANCED GAME DESIGN | 4 quarter hours**(Undergraduate)**

In this studio course, students work individually to design and develop small-scale narrative game experiences. For this course, "narrative" is experienced through the different components of the game, including storytelling, interactions, movement, and visual design. The focus of this course is on expressive, communicative story experiences rather than systems-design. Through several short development sprints, students will design small games that explore experiential and emotional design in games, understanding games as an expressive medium.

(GAM 340 and GAM 341) or GAM 355 is a prerequisite for this class.

GAM 368 | AUGMENTED REALITY GAME DESIGN AND DEVELOPMENT | 4 quarter hours**(Undergraduate)**

In this workshop students cultivate the skills to design, program and develop augmented reality (AR) games. Students learn about the unique affordances and design opportunities inherent to the platform. Based on the studio model, each student adopts a role on the development team, such as programmer, designer, and artist, and each is responsible for contributing professional work consistently each week. Because the platform of AR games presents unique challenges to developers (players often feel disoriented or over-tasked) teams first create a dozen AR toys, and build up the most promising experiences into games. Class time consists of lectures, workshops, workdays, playtests, critiques, and class discussions.

GAM 245 is a prerequisite for this class.

GAM 369 | VIRTUAL REALITY GAME DEVELOPMENT | 4 quarter hours**(Undergraduate)**

In this workshop students cultivate the skills to design, program, and develop VR (virtual reality) games. Students learn about the unique affordances and design opportunities inherent to the platform. Topics include the history of VR, VR art, as well as toy design and development. Students collaboratively develop cutting-edge VR toys and games using the studio model in which each student adopts a professional role on the team such as programmer, designer, and artist. Class time consists of lectures, workshops, workdays, playtests, critiques, and class discussions.

GAM 245 is a prerequisite for this class.

GAM 370 | RENDERING AND GRAPHICS PROGRAMMING | 4 quarter hours**(Undergraduate)**

This programming class will present the rendering pipeline and basic shader creation. Students will create their own graphics package using a high-level graphics API such as Direct X. Topics covered include illumination techniques, Gouraud and Phong shading, antialiasing techniques, texture mapping, blending and environment mapping.

GAM 325 and CSC 361

GAM 372 | OBJECT-ORIENTED GAME DEVELOPMENT | 4 quarter hours (Undergraduate)

Students will learn principles and techniques needed to build robust and efficient large scale game software systems. Principles of object-oriented modeling, design, implementation, and testing of large-scale game systems will be emphasized. Topics include design patterns, application frameworks, architectural design, and the applications in the software development process to improve the extensibility, maintainability, and reliability of software systems.

CSC 361 is a prerequisite for this class

GAM 374 | GAME ENGINE PROGRAMMING I | 4 quarter hours (Undergraduate)

Students will develop a basic 3D game engine. The focus will be on the implementation challenges and interdependencies between systems such as asset management, rendering, simple collisions, input/output, alarms, etc. Emphasis will be placed on developing the skills needed for robust, efficient, and portable implementation.

GAM 372 and GAM 325 are prerequisites for this class

GAM 376 | ARTIFICIAL INTELLIGENCE FOR COMPUTER GAMES | 4 quarter hours (Undergraduate)

Artificial Intelligence (AI) is one of the essential components of a computer game. The course introduces basic concepts of AI. Emphasis will be placed on applications of AI in various genres of computer games. In the implementation component of this course students will be exposed to the existing AI game engines (middleware), which contain implemented AI algorithms that are ready to be applied into game code. These algorithms include: decision trees, pathfinding, neural networks, and script-driven game object behaviors.

GAM 372 or (SE 350 and CSC 361) are prerequisites for this class.

GAM 377 | GAME ENGINE PROGRAMMING II | 4 quarter hours (Undergraduate)

This class is a continuation of GAM 374. Students develop more complex systems for their 3D game engines: improved collision systems, terrain generation, and particle systems. Other advanced engine services are discussed and students are expected to research and implement one such system: sounds management, lighting system, tiered/broad phase collision system, advanced camera manipulation, etc.

GAM 374 is a prerequisite for this class.

GAM 378 | STRATEGY GAMES PROGRAMMING | 4 quarter hours (Undergraduate)

Turn-based and real-time strategy games. Abstract strategy games such as chess, backgammon, and bridge. Game themes and presentation of fantasy, historical and futuristic gaming scenarios. Ethically responsible content and social impact of different cultures, ethnicities, genders on the game play and game audience will be addressed. Game-player resource management. Implementation of strategy engines, 2D presentation and isometric projection.

GAM 376 is a prerequisite for this class.

GAM 379 | ADVANCED VIRTUAL REALITY GAME DEVELOPMENT | 4 quarter hours (Undergraduate)

Students in this course iteratively develop compelling VR games / experiences by working independently or in cross-disciplinary teams. Students learn about the most exciting advances in the field of VR games and entertainment. There is still much to be invented in the kinds of play experiences VR makes possible by using the affordances of embodied input and immersion. Students are exposed to emerging technologies that transform and enhance virtual reality development such as generative artificial intelligence. Students are encouraged to explore experimental techniques, take bold risks, and determine their own vision of what VR experiences can be and what players do.

GAM 380 | CONSOLE GAME DEVELOPMENT ENVIRONMENTS | 4 quarter hours (Undergraduate)

Specialized computers for games with high-end graphics and sound capabilities and other specialized input and output devices form one of the largest game markets. In this advanced programming course students will gain hands-on experience writing and porting code for game consoles.

CSC 393 and CSC 374 are prerequisites for this class.

GAM 382 | SERIOUS GAMES | 4 quarter hours (Undergraduate)

Explores the role of computer games and simulations for education and training. Topics include: overview of the science of learning, analysis of games for different purposes and types of content, assessment of learning, and learning through game creation. Students will design, implement, and evaluate a serious game. Development of socially responsible and ethical behaviors will be a primary objective.

GAM 245 is a prerequisite for this class.

GAM 383 | GAME STUDIO DEVELOPMENT | 4 quarter hours (Undergraduate)

This course focuses on the development cycle in a large game studio with a focus on pushing out a game targeted towards a commercial platform. The game in question is an ongoing development taking place over a number of years, Students participate quarterly and a public build will be made available at the end of the school year. This class can be taken multiple times but requires permission from the instructor each time. Each student will have a particular role in the studio where they will focus on developing mastery to help build the game over the course of the quarter. Available design roles include: Level Design, Gameplay design, UI Design, Graphic Design, Character Animation, Blueprint Specialist, Balancing, Narrative and Dialog, Writing, Cinemas and cutscenes, Production. Getting into the class requires the student to show a portfolio or display some level of mastery in one of the available areas to participate.

GAM 386 | GAME PROGRAMMING FOR MOBILE DEVICES | 4 quarter hours (Undergraduate)

In this course we introduce major mobile hardware platforms and their operating systems. Issues related to game design for handheld devices will be presented. The strong technical component of this course includes game programming for a handheld device with a wireless internet connection enabling multiplayer game architecture. Such concepts as: building a custom game library, multiplayer game programming, infrared, wireless and socket communication between devices will be discussed.

CSC 371 is a prerequisite for this class.

GAM 391 | GAME PERFORMANCE OPTIMIZATION | 4 quarter hours (Undergraduate)

This game programming class will focus on developing software to efficiently use the fixed CPU power and resources that are found in today's console and mobile devices. This course will use real-world game examples that demonstrate performance and optimization issues that software architects face in game development. These problems include: performance enhancements through extended matrix instruction set, dynamic memory usages, performance related to increasing run-time systems to very large scale, C++ language enhancements and extensions, algorithms, streaming and profiling. PREREQUISITE(S): (CSC 301 or CSC 383 or CSC 393) and CSC 374.

GAM 392 | GAME MODIFICATION WORKSHOP | 4 quarter hours (Undergraduate)

In this course, students will develop skills in game design and development through the construction of a "mod" of an existing game. Emphasis will be placed on the game development life cycle from concept through release, on productivity in a team environment, and on effective project management practices.

GAM 355 or GAM 372 or (ANI 344 and GAM 341) are prerequisites for this class.

GAM 394 | GAME DEVELOPMENT CAPSTONE I | 4 quarter hours (Undergraduate)

Students work in teams to design and develop a videogame that demonstrates their mastery of game design and development. Additionally, students will reflect on ethical decision making and professional ethics in the game industry. This course and its continuation, GAM 395, must be taken consecutively.

GAM 355 or GAM 377 or (GAM 344 and GAM 392) and Senior Status are prerequisites for this class.

GAM 395 | GAME DEVELOPMENT PROJECT II | 4 quarter hours (Undergraduate)

Continuation of GAM 394.

GAM 394 is a prerequisite for this class.

GAM 397 | TOPICS IN GAME DESIGN | 4 quarter hours (Undergraduate)

Specific topics selected by the instructor. Topic varies with each offering. Contact instructor for more information. Prerequisite(s): See syllabus.

GAM 398 | TOPICS IN GAME PROGRAMMING | 1-4 quarter hours (Undergraduate)

Specific topics will be selected by the instructor and will vary with each quarter. PREREQUISITE(S): See syllabus (variable credit)

GAM 399 | INDEPENDENT STUDY | 1-8 quarter hours (Undergraduate)

Independent study supervised by an instructor. Independent study form required. Can be repeated for credit. Variable credit. PREREQUISITE(S): None (variable credit)

GAM 420 | CREATIVE COMPUTATION | 4 quarter hours (Graduate)

Students are introduced to the affordances of computers and digital technology as a medium using foundational texts from the discipline of digital media while being introduced to programming. The course teaches students to discover how to effectively and creatively communicate their ideas using accessible coding environments and engines and challenges them to build playful, interactive applications.

GAM 424 | GAME DESIGN WORKSHOP | 4 quarter hours (Graduate)

This course is an introduction to both the theory and practice of game design. Students will explore fundamental elements of game design and put these concepts to work in designing, prototyping, playtesting, and developing both physical and computer games. The course will cover formal elements of games, game dynamics, game narratives, and the dramatic components of games. Students will study the game design process including brainstorming, conceptualization, creation of design documentation, and play-testing. PREREQUISITE(S): none.

GAM 425 | APPLIED 3D GEOMETRY | 4 quarter hours (Graduate)

Review of mathematical foundation and techniques needed for the development of 3D graphics and game systems. This class will provide the foundation in linear algebra and 3D geometry required for implementing common tasks in 3D graphics and game systems. Topics include: vectors, matrices, transforms, coordinate changes, projections, intersection, interpolation and random number generator.

CSC 403 is a prerequisite for this class.

GAM 426 | GAME SOUND DESIGN 2 | 4 quarter hours (Graduate)

Students will further their knowledge of recording techniques for voiceover, sound effects, and music; editing voiceover and music; and mixing. The course will also introduce audio implementation using Unity. Coursework will utilize the recording studio extensively for in-class and out-of-class work. The course is intended for advanced students who wish to develop their skills and gain more experience in preparing and mixing sound designs for video games.

GAM 427 | SCORING FOR GAMES | 4 quarter hours (Graduate)

Students are introduced to elements of music and ways in which these elements may be used to create a musical style that enhances video games. The course emphasizes understanding the function of the score and how it relates to texture, color, and drama in music. Students explore their creativity using the tools available, work on projects of increasing complexity, and complete a score for their own video game as a final project. Listening skills, music vocabulary, and business and legal aspects of the profession are also studied.

GAM 426 is a prerequisite for this course.

GAM 428 | GAME SOUND DESIGN AND SCORING STUDIO | 4 quarter hours (Graduate)

This course is intended to provide practical experience in audio production for video games, as well as to offer the opportunity to create quality materials to include in a demo reel or portfolio. It will build on the background and skills acquired in Game Sound Design 2. Students will study the sound designs of different genres of video games, and then complete five projects in which they will be creating the sound designs for games of those genres. A key element of this course will be in-class discussions and critiques of students' work, both to sharpen their sound designing and critical listening skills.

GAM 430 | ART GAMES BOOTCAMP | 4 quarter hours (Graduate)

Students learn to appreciate and advance games as an artistic medium in this bootcamp by making work that is avant-garde in its formal aesthetics or sociopolitical force. Every two weeks students rapidly develop and complete an art game that challenges the conventional wisdom of what games are, how and why we play them, and the role they perform in popular culture.

**GAM 434 | THE BUSINESS OF INDIE GAMES | 4 quarter hours
(Graduate)**

This class will explore how to successfully run an indie game company using an arsenal of best practices. Topics include how to write a game design document for marketability and a business plan for an indie studio, as well as how to build and maintain relationships with the media. Students will also gain an understanding of how indie games fit into the game industry as a whole.

**GAM 435 | GAME ENGINES FOR CINEMATIC EFFECTS AND VIRTUAL PRODUCTION | 4 quarter hours
(Graduate)**

This course focuses on teaching both filmmakers, designers and artists the fundamentals of a game engine. Topics include how to develop or import materials, environment pieces, animations, as well as creating lighting, post processing and cinematics. Emphasis will be placed on creating 3D set pieces and cinematic sequences. No previous experience with 3D is required.

**GAM 440 | GAMES WITH A PURPOSE BOOTCAMP | 4 quarter hours
(Graduate)**

This game design bootcamp focuses on the rapid yet deliberate creation of short games with a purpose beyond entertainment. Every two weeks, students are expected to deliver a completed game project that addresses a real-life issue, has a clear statement of intent and uses their specific properties of games as a medium to achieve its declared purpose.

**GAM 450 | PHYSICS FOR GAME DEVELOPERS | 4 quarter hours
(Graduate)**

The course concentrates on Newton's Laws of Motion, kinematics and kinetics. This theory will be applied to problems that a game programmer must understand e.g. collisions between objects, projectiles and their trajectories, real-time simulation of motion. Special objects such as cars, aircraft and ships will be discussed. Students will apply and implement laws of physics.

CSC 461 and (SE 456 or SE 450) are prerequisites for this class.

**GAM 451 | EXPRESSIVE AUDIO SCRIPTING FOR GAMES | 4 quarter hours
(Graduate)**

This workshop is for game designers, sound designers and programmers to learn how to creatively use audio in game engines. Students develop skills to effectively shape and manipulate game audio to achieve intended dramatic experiences. Topics include key terms and techniques, industry trends in game audio implementation, and how to advance the medium of games through audio. Students listen and critique each other's work, learning to assess game audio in terms of narrative, aesthetics and quality. PREREQUISITE(S): None.

**GAM 453 | TOOL PROGRAMMING FOR GAME DEVELOPMENT | 4 quarter hours
(Graduate)**

This course focuses on the parsing and conditioning of game related assets for real-time game engines. Topics include the content pipeline, processing or standard file formats using modern API, integration of external tools, run-time file format design, command line and graphical user interfaces. Adaptive real-time modification of data structures in game using managed languages (such as C#) reflection will be explored. **CSC 461 and (SE 456 or SE 450) are prerequisites for this class.**

**GAM 462 | RITUAL, MYTH AND GAMES | 4 quarter hours
(Graduate)**

This class focuses on the intersection of ritual, myth, and games, and how they can facilitate personal transformation through contemplation of the "existential givens": birth, death, freedom, isolation, identity and the "meaning of life". We will draw on philosophy, anthropology, sociology, spiritual practices, psychotherapy as well as game design, theatre / performance study and fabrication ("making") to develop an interdisciplinary, creative framework for the design of playful, myth-based, transformational experiences. Our focus is on non-digital and hybrid playspaces to take full advantage of the power of embodiment and physio-psychological immersion in ritual performance and the enactment of myth. PREREQUISITE(S): None.

**GAM 469 | VIRTUAL REALITY GAME DEVELOPMENT | 4 quarter hours
(Graduate)**

In this workshop students cultivate the skills to design, program, and develop VR (virtual reality) games. Students learn about the unique affordances and design opportunities inherent to the platform. Students are exposed to emerging technologies that transform and enhance virtual reality development such as new capabilities of hand and gesture tracking as well as generative artificial intelligence. Students collaboratively develop cutting-edge VR toys and games using the studio model in which each student adopts a professional role on the team such as programmer, designer, artist, director, etc. Class time consists of lectures, workshops, workdays, playtests, critiques, and class discussions.

**GAM 470 | RENDERING AND GRAPHICS PROGRAMMING | 4 quarter hours
(Graduate)**

This programming class will present the rendering pipeline and basic shader creation. Students will create their own graphics package using a high-level graphics API such as Direct X. Performance issues will be considered as part of the API design. Topics covered include illumination techniques, Gouraud and Phong shading, antialiasing techniques, texture mapping, blending and environment mapping, reflection and hardware instancing.

GAM 425 and CSC 461 are prerequisites for this class.

**GAM 475 | REAL - TIME SOFTWARE DEVELOPMENT | 4 quarter hours
(Graduate)**

Real-time software development. Topics include runtime library construction, abstracting low-level systems, custom data containers, memory tracking, framework development, real-time design patterns, low-level drivers, and graphics engine development. Design and implementation of multi-heap memory management system with aligned allocations with cross heap tracking. Exploration of run-time control of behavior through real-time data driven messaging. Interface development to create a responsive optimized access to abstract data types. Students will design, develop and implement a real-time application (i.e. Graphics engine) that integrates multiple user-developed libraries with real-time constraints.

CSC 461 and (SE 456 or SE 450) are prerequisites for this class.

GAM 476 | ARTIFICIAL INTELLIGENCE FOR COMPUTER GAMES | 4 quarter hours (Graduate)

Artificial Intelligence (AI) is one of the essential components of a computer game. The course introduces basic concepts of AI. Emphasis will be placed on applications of AI in various genres of computer games. In the implementation component of this course students will be exposed to the existing AI game engines (middleware), which contain implemented AI algorithms that are ready to be applied into game code. These algorithms include: decision trees, pathfinding, neural networks, and script-driven game object behaviors.

CSC 461 and (SE 456 or SE 450) are prerequisites for this class.

GAM 479 | ADVANCED VIRTUAL REALITY GAME DEVELOPMENT | 4 quarter hours (Graduate)

Students in this course iteratively develop compelling VR games / experiences by working independently or in cross-disciplinary teams. Students learn about the most exciting advances in the field of VR games and entertainment. There is still much to be invented in the kinds of play experiences VR makes possible by using the affordances of embodied input and immersion. Students are exposed to emerging technologies that transform and enhance virtual reality development such as generative artificial intelligence. Students are encouraged to explore experimental techniques, take bold risks, and determine their own vision of what VR experiences can be and what players do.

GAM 486 | GAME PROGRAMMING FOR MOBILE DEVICES | 4 quarter hours (Graduate)

In this course we introduce major mobile hardware platforms and their operating systems. Issues related to game design for handheld devices will be presented. The strong technical component of this course includes game programming for a handheld device with a wireless internet connection enabling multiplayer game architecture. Such concepts as: building a custom game library, multiplayer game programming, infrared, wireless and socket communication between devices will be discussed.

CSC 471 is a prerequisite for this class.

GAM 491 | GAME PERFORMANCE OPTIMIZATION | 4 quarter hours (Graduate)

This game programming class will focus on developing software to efficiently use the fixed CPU power and resources that are found in today's console and mobile devices. This course will use real-world game examples that demonstrate performance and optimization issues that software architects face in game development. These problems include: performance enhancements through extended matrix instruction set, dynamic memory usages, performance related to increasing run-time systems to very large scale, C++ language enhancements and extensions, algorithms, streaming and profiling. **PREREQUISITE(S):** CSC 400 and CSC 403 and CSC 407.

GAM 499 | TOPICS IN COMPUTER GAME DESIGN AND DEVELOPMENT | 1-4 quarter hours (Graduate)

Variable topics course in computer game design and development. May be repeated for credit. **PREREQUISITE(S):** Permission of instructor (variable credit)

GAM 520 | GAME DESIGN PROSEMINAR | 4 quarter hours (Graduate)

In this foundational seminar course, students are exposed to significant written works that examine the medium of games in historical, cultural, and social contexts. Students analyze and interpret games in classroom discussions and written explorations that reveal the meaning and values of games as cultural artifacts. In doing so, they learn to situate their own critical practice within the history of the medium.

GAM 530 | GAMES STUDIES PROSEMINAR | 4 quarter hours (Graduate)

This seminar class introduces students to a broad range of historical and current topics in game studies. It aims to support creative practice by expanding the theoretical foundation established in Game Design Proseminar with additional, deep insight into disciplines that relate to games, play, players, learning, activism, and art.

GAM 540 | GAME DEVELOPMENT PRACTICUM | 4 quarter hours (Graduate)

This course introduces the creation of a term-long project in teams. In contrast to studio classes where students can work alone or with others and decide what games they want to create, the practicum requires students to make games about a specific topic or theme proposed by faculty. This can include a requirement of working with a client, involving subject matter experts in the design process, developing a site-specific art game installation, or working with a novel platform such as a wearable device.

GAM 550 | INCUBATION STUDIO | 4 quarter hours (Graduate)

Students situate their creative practice within historical, aesthetic, and social contexts. This includes an introspective analysis of why they want to design games. Students identify potential research areas or creative catalysts for their thesis projects, conducting research, critiquing and analyzing relevant work, technologies, and reference materials. The final course assignment is a thesis proposal outlining their project plans for Thesis Studio, which each student must get approved by their advisor before entering Thesis Studio.

GAM 420 or GAM 530 or GAM 540 is the prerequisite for this course.

GAM 575 | REAL-TIME SOFTWARE DEVELOPMENT II | 4 quarter hours (Graduate)

Real-time software development with asset conversion. Topics include offline data conversion, asset packing, data driven application behavior, hierarchy base scene management, profiling and debugging large opaque data, runtime formats for low-level drivers, and advanced visualization techniques. Design and implementation of hierarchy based data systems with dynamic real-time modifications. Exploration of run-time control of behavior through real-time data driven messaging. Implementation of the complete application process: tool creation, asset condition, responsive loading and data driven runtime behavior. Students will design, develop and implement a real-time application (i.e. Animation engine) that integrates large real-time converted data assets with real-time constraints.

GAM 475 is a prerequisite for this class.

**GAM 576 | GPU ARCHITECTURE | 4 quarter hours
(Graduate)**

Real-time application GPU development. Topics include GPU pipeline, data parallelization, hierarchy data flow on GPU, asset compression, non-graphics data processing, graphics rendering and data conversion. Design and implementation of parallel GPU applications across multiple GPU cores. Exploration of different parallelization techniques for large (non-graphical) computationally heavy systems. Developing and debugging blind data flow on GPU hardware. Students will design, develop and implement a real-time GPU application (i.e. Skinned Animation rendering engine) that integrates large converted data assets using 100s of parallel GPU cores.

GAM 575 is a prerequisite for this class.

**GAM 594 | GAMING AND ENTERTAINMENT TECHNOLOGY CAPSTONE | 4 quarter hours
(Graduate)**

This course gives students an opportunity to utilize knowledge obtained in this degree program in developing a computer game, from conceptualization, design, to implementation. Issues in project management and configuration management will also be addressed. This work will constitute a major part of the project portfolio that students have developed during their study. PREREQUISITE(S): Completion Of Foundation Courses.

**GAM 597 | TOPICS IN GAME DESIGN | 4 quarter hours
(Graduate)**

Specific topics selected by the instructor. Topic varies with each offering. Contact instructor for more information. PREREQUISITE(S): See syllabus.

**GAM 598 | TOPICS IN GAME PROGRAMMING | 1-4 quarter hours
(Graduate)**

Specific topics will be selected by the instructor and will vary with each quarter. PREREQUISITE(S): For specific prerequisites, see syllabus or consult course instructor. (variable credit)

**GAM 599 | INDEPENDENT STUDY | 1-8 quarter hours
(Graduate)**

Independent study supervised by an instructor. Independent study form required. Can be repeated for credit. Variable credit. PREREQUISITE(S): None (variable credit)

**GAM 600 | THESIS STUDIO | 4 quarter hours
(Graduate)**

Students demonstrate their abilities as professional contributing artists in the field of games through the completion of a thesis project that advances the medium of games historically, aesthetically, or socially. Students will be required to publically show their thesis work as well as defend it before an appointed committee of faculty knowledgeable in the field. PREREQUISITE(S): GAM 550.

**GAM 690 | GAME DEVELOPMENT STUDIO I | 4 quarter hours
(Graduate)**

In this course and its continuation GAM 691, students will work in small teams to design and implement a computer game. The courses must be taken consecutively.

GAM 475 is a prerequisite for this class.

**GAM 691 | GAME DEVELOPMENT STUDIO II | 2-4 quarter hours
(Graduate)**

Continuation of GAM 690. (variable credit)

GAM 474 or SE 456 are a prerequisite for this class

**GAM 695 | MASTER'S GAME RESEARCH STUDY | 4 quarter hours
(Graduate)**

Students interested in a more in-depth study of a particular game area will register for this course and work with a faculty member (not necessarily their academic advisor) on a research project. The work involved may include system development, empirical studies, or theoretical work. Can be taken for up to 8 credit-hours. PREREQUISITE(S): GAM 575 and consent of research advisor.

**GAM 701 | THESIS CONTINUATION | 0 quarter hours
(Graduate)**

Non-credit. Students enrolled in the MFA program who have completed all the required courses and thesis registration requirements must be enrolled each quarter of the academic year until the thesis and defense have been completed. Registration through the independent study form requires certification that the student is actively working on the thesis under the advisor's supervision. This course carries the equivalent of full-time enrollment status.

12 credit hours of GAM 600 is a prerequisite for this course.