DEREE COLLEGE SYLLABUS FOR: GAM 4343 ARTIFICIAL INTELLIGENCE TOPICS FOR GAME DEVELOPMENT 3/0/3

(New Course Fall 2026)

UK LEVEL: 6
UK CREDITS: 15

PREREQUISITES:	ITC 2164 Fundamentals of Artificial Intelligence ITC 3006 Mathematics for Computing ITC 2053 Introduction to Game Programming -***OR***- ITC 2088 Introduction to Programming
CATALOG DESCRIPTION:	Artificial-intelligence paradigms and game-theoretic models that underpin contemporary digital games. Topics include: MCTS, procedural content generation, player-experience modelling, and using AI for game balancing.
RATIONALE:	This course explores the AI techniques that are commonly used in game development. Building upon knowledge the students have from prerequisite courses, they learn key algorithms used in real digital games, such as Monte Carlo Tree Search and evolutionary methods, and used for procedural content generation. It also covers the mathematical foundations of game theory upon which AI strategic interactions are based, as well as practical examples of AI used in game development, and AI used for game balancing.
LEARNING OUTCOMES:	As a result of taking this course, the student should be able to: 1. Demonstrate in depth understanding of AI algorithms related to game development. 2. Adapt the most pertinent AI algorithms to specific game development challenges and evaluate the results. 3. Critically analyse the game balance and player immersion using AI agents and game analytics. 4. Design AI components for games adapting the algorithms and techniques learned.
METHOD OF TEACHING AND LEARNING:	In congruence with the teaching and learning strategy of the college, the following tools are used: • Classroom lectures, discussions, use of generative AI tools to inform course content and review of theoretical concepts. Laboratory practical sessions. • Office hours: Students are encouraged to make full use of the office hours of their instructor, where they can ask questions and go over lecture material. • Use of the Blackboard Learning platform, where instructors post lecture notes, assignment instructions, timely announcements, as well as additional resources.
ASSESSMENT:	**Summative:** Final assessment: **Project** Analysis, design and programming of one or more artificial intelligence components for a game or game genre. — **100%** **Formative:** In class and home short problems and quizzes — **0%** The formative assessments aim to prepare students for the summative assessments and expose them to teamwork.

	The final summative assessment tests LOs 1-4. *Students are required to resit failed assessments in this module.*
INDICATIVE READING:	**REQUIRED READING:** 1. Yannakakis, G. N. & Togelius, J. (2025). *Artificial Intelligence and Games (2nd edition).* Springer. **RECOMMENDED READING:** 1. Stuart, R. and Peter, N. (2021). *Artificial Intelligence: A Modern Approach.* Upper Saddle River, NJ: Prentice-Hall 2. Shaker, N., Togelius, J. and Nelson, M. J. (2016) *Procedural Content Generation in Games*, Springer. 3. Myerson, R. B. (2013). *Game Theory*. Harvard university press. 4. Short, T., & Adams, T. (Eds.). (2017). *Procedural Generation in Game Design*. CRC Press. 5. Short, T. X., & Adams, T. (Eds.). (2019). *Procedural Storytelling in Game Design*. CRC Press. 6. Rabin, S. (Ed.). (2013). *Game AI Pro: Collected Wisdom of Game AI Professionals*. CRC Press.
INDICATIVE MATERIAL: *(e.g. audiovisual, digital material, etc.)*	**REQUIRED MATERIAL**: N/A **RECOMMENDED MATERIAL:** N/A
COMMUNICATION REQUIREMENTS:	Daily access to the course's site on the College's Blackboard CMS. Use of word processing, spreadsheet and/or presentation graphics software for documentation of assignments
SOFTWARE REQUIREMENTS:	MS-office, Blackboard CMS Java, Python, C, C# Unity LTS Microsoft Visual Studio and other IDEs for the various languages
WWW RESOURCES:	• Textbook website: https://gameaibook.org/ • Game AI pro: https://www.gameaipro.com/ • AAAI Conference on Artificial Intelligence and Interactive Digital Entertainment: http://aiide.org/ • IEEE Conference on Games (e.g. https://cog2025.inesc-id.pt/) • IEEE Transactions on Games: https://ieeexplore.ieee.org/xpl/RecentIssue.jsp?punumber=7782673 • https://www.youtube.com/@AIandGames
INDICATIVE CONTENT:	Foundations of Game Artificial Intelligence • Roles of Artificial Intelligence in games, including intelligent agents and game environments • Game-playing techniques and algorithms, including search methods, Monte Carlo Tree Search (MCTS), and evolutionary approaches • Applications of AI for gameplay, decision-making, and player interaction Game Theory and Computational Decision-Making • Utility, probability, and mathematical foundations for game design • Normal and extensive form games, Nash equilibria, minimax strategies, and repeated games • Applications of game theory to balancing mechanics, in-game

	economies, and multi-agent coordination Procedural Content Generation and Player Modelling • Procedural content generation methods and algorithms • Generation of levels, maps, rules, mechanics, and emergent narratives • Player modelling, player analytics, and behaviour-driven game design Game Balancing, Ethics, and Emerging Topics • AI-driven game balancing and adaptive gameplay systems • AI directors, dynamic difficulty adjustment, and gameplay immersion • Ethics, responsible AI in games, and future directions in game AI