Course Unit	Mathematics for Games		**Field of study**	Mathematics		
Bachelor in	Game Design		**School**	School of Public Management, Communication and Tourism		
Academic Year	2023/2024	**Year of study** 1	**Level** 1-1		**ECTS credits**	6.0
Type	Semestral	**Semester** 1	**Code**	8309-801-1102-00-23		

Workload (hours)	162	Contact hours	T	-	TP	60	PL	-	TC	-	S	-	E	-	OT	-	O	-

T - Lectures; TP - Lectures and problem-solving; PL - Problem-solving, project or laboratory; TC - Fieldwork; S - Seminar; E - Placement; OT - Tutorial; O - Other

Name(s) of lecturer(s)	Ines Monteiro Barbedo de Magalhaes

Learning outcomes and competences

At the end of the course unit the learner is expected to be able to:
1. Read, write and use the language of mathematics fluently
2. Use functions to describe, modell and solve real life problems
3. Prove to have achieved knowledge which supports the learning of Computing Science and Visual Art scientific areas

Prerequisites

Before the course unit the learner is expected to be able to:
Understand the use of Mathematics - medium level

Course contents

Introduction to Diferential Calculus: Real functions. The derivative of a function and applications. Exponential function. Logarithmic function. Linear Algebra and Analytic Geometry: Matrices. Trigonometry. Vector Calculus. Geometric tranformations.

Course contents (extended version)

1. Introdution to differential calculus
    - Real function of real variable Definition of function. Graph of a function.
    - Study of the characteristics of a function: domain, zeros, sign, monotony.
    - Linear, quadratic and rational functions.
    - Absolute and local extrema. Injectivity.
    - Exponencial function. Definition and proprieties. Operation rules.
    - Logarithmic function. Definition and proprieties. Operation rules.
    - Derivate of a function. Definition and rules. Applications of the derivative.
    - Applications of first and second derivatives. The graph of a function
    - Some topics in physics: acceleration, mass and energy. Newton's laws.
2. Linear Algebra and Analytic Geometry
    - Matrices. Definitions. Operations with matrices and properties.
    - The inverse matrix. Transpose of a matrix.
    - Determinant of a matrix of 1st, 2nd and 3rd order.
    - Trigonometry. Pythagorean trigonometry identity and formulas.
    - Trigonometric relations; remarkable values. Solving triangles.
    - Vectorial calculus. Representing points and vectores in aorthonormal reference; a standard vector.
    - Vector operations: adiction, scalar product, normalization and polar form.
    - Lines and planes, circles and spheres. Related position. Dot product and cross product.
    - Polygon and polyhedra. Some properties.
    - Geometric transformations. Rotation, translation, reflection, scale and projection.

Recommended reading

1. Dunn, F. & Parberry, I. (2011). 3D Math Primer for Graphics and Game Development. (2nd ed.). A K Peters/CRC Press [ISBN-13: 978-1568817231]
2. Flynt, J. P. & Kodicek, D. (2012) Mathematics and Physics for Programmers (2nd ed.) CENGAGE Learning [ISBN: 1435457331]
3. Stahler, W. (2006). Fundamentals of Math and Physics for Game Programmers. Prentice Hall [ISBN: 0131687425]
4. Trembley, C. (2004). Mathematics for game developers. Thomson Course Technology / Premier Press [ISBN: 159200038X]
5. Barbedo, I. (2018) Apontamentos de Matemática para Jogos, EsACT

Teaching and learning methods

CLASSES AND TEACHING SUPPORT Classes will be fit-oriented to: overcome difficulties; share successes and difficulties; show and explain examples using audio-visual presentations; exploit examples related to case studies; simulate examples using a computer; discuss proposed projects. The student must do previous homework; team working must de encouraged.

Assessment methods

- Final Evaluation (incoming students) - (Regular, Student Worker) (Final, Supplementary, Special)
    - Practical Work - 50% (3 out of 4 proposals)
    - Development Topics - 10% (Interdisciplinar Week)
    - Final Written Exam - 40% (All syllabus (minimum mark 7 points in 20))

Language of instruction

Portuguese, with additional English support for foreign students.

Electronic validation

Ines Monteiro Barbedo de Magalhaes	Barbara Costa Vilas Boas Barroso	Anabela Neves Alves de Pinho	Luisa Margarida Barata Lopes
06-10-2023	09-10-2023	10-10-2023	06-11-2023