ACADEMIC PROGRAM

FOUNDATIONS OF MATHEMATICS AND PHYSICS

B.F.A. IN **INTERACTIVE PRODUCT DESIGN**

MODALITY: ON CAMPUS

ACADEMIC YEAR: 2023-2024

Name of the course:	Foundations of Mathematics and Physics
Degree :	Interactive Product Design
Location:	Centro Universitario de Tecnología y Arte Digital
Modulo:	Art, Science and Technology
Area:	Foundations of development
Year:	1º
Teaching period:	1º
Type:	B
ECTS credits:	6
Teaching modality:	On campus
Language:	English
Lecturer / Email	Beatriz Martinez Pabón / beatriz.pabon@u-tad.com
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SUBJECT DESCRIPTION

Area description

This area refers to the study and practice of the set of fundamental concepts that allow the foundation of the concepts of video game development from the technological, programming and mathematical aspects.

Subject description

This subject belongs to the module of art, science and technology and within this to the subject of fundamentals of development.

This subject is the theoretical basis for "Introduction to programming" and forms part of the theoretical knowledge for "Technology for designers". In addition, it develops interdisciplinary aspects with the development in the student of basic mathematical aspects useful for the academic process.

It is a fundamental subject for knowing and mastering the theoretical and practical bases that underpin the basic knowledge of mathematics and physics applied to the design of interactive products.

COMPETENCIES AND LEARNING OUTCOMES

Competencies

Basic and general competences

GC17 - Demonstrate the ability to analyse, synthesise and gather information from different sources.

GC18 - Manage information appropriately.

GC1 - Lifelong learning through self-study and lifelong learning.

CB1 - That students have demonstrated possession and understanding of knowledge in an area of study that builds on the foundation of general secondary education, and is usually at a level that, while relying on advanced textbooks, also includes some aspects that involve knowledge from the cutting edge of their field of study.

CB2 - Students are able to apply their knowledge to their work or vocation in a professional manner and possess the competences usually demonstrated through the development and defence of arguments and problem solving within their field of study.

CB3 - Students have the ability to gather and interpret relevant data (usually within their field of study) in order to make judgements that include reflection on relevant social, scientific or ethical issues.

CB4 - Students are able to communicate information, ideas, problems and solutions to both specialist and non-specialist audiences.

CB5 - That students have developed those learning skills necessary to undertake further study with a high degree of autonomy.

Specific competences

SC6 - Apply the practical fundamentals of mathematics and physics to the creation of an interactive digital product.

SC7 - Knowing the practical fundamentals of the use and programming of computers and interactive product development tools.

SC8 - Evaluate the ethical, technical and creative implications of technology in the design of interactive products.

Learning outcomes

Use elementary technical knowledge in the creative design process.

Evaluate the possibilities and restrictions imposed by technology in the construction of the videogame.

Apply the elements of kinematics and dynamics to the design.

Know the syntax and basic use of the programming languages intended for the design of video games.

Develop basic programs accompanied by simple test batteries

Manage the most common operating systems and work environments

Develop simple games in scripting languages

CONTENTS

· Mathematical foundations for the design of video games and interactive products

• Physics foundations for the design of video games and interactive products

SUBJECT SYLLABUS

1. Trigonometry and Vectors
    1.1. Trigonometric ratios.
    1.2. Definition and characteristics of vectors
    1.3. Operations with vectors
2. Matrices and their application to Computational Geometry
    2.1. Definition of matrix
    2.2. Operations with matrices
    2.3. Homogeneous transformations in D and 3D.
    2.4. Composition of transformations.
3. Statistics and Probability
    3.1. Basic concepts of statistics.
    3.2. Introduction to Probability
    3.3. Combinatorics
4. Introduction to Boolean Algebra
    4.1. Language and logic gates
    4.2. Truth Tables and Logic Functions.
5. Kinematics
    5.1. Magnitudes of Motion
    5.2. Types of Motion
6. Forces and their effects.
    6.1. Types of Forces.
    6.2. Dynamics. Newton's Laws.
    6.3. Applications.
7. Energy and Collisions
    7.1. Manifestations of energy.

7.2. Linear momentum and its conservation.

7.3. Types of collisions

8. Rigid Body.

8.1. Center of mass

8.2. Moment of inertia.

TRAINING ACTIVITIES AND TEACHING METHODOLOGIES

TRAINING ACTIVITIES

LEARNING ACTIVITIES	Total hours	Hours of presence
Theoretical classes	40,77	40,77
Seminars and workshops	3,08	3,08
Practical classes	11,54	11,54
Tutorials	5,38	5,38
Evaluation Activities	6,92	6,92
Group work and study	20,00	1,00
Autonomous and individual study and work	62,31	0,00
TOTAL	150	69

Teaching methodologies

Expository method/Master lecture

Case studies

Exercise and problem solving

TEMPORAL DEVELOPMENT

Topics 1,2: 4 weeks

Topics 3,4: 5 weeks

Topics 5,6,7,8: 6 weeks

EVALUATION SYSTEM

ASSESSMENT SYSTEM	MINIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)	MAXIMUM SCORE RESPECT TO THE FINAL ASSESSMENT (%)
Assessment of participation in class, exercises or projects of the course	10	30
Assessment of assignments, projects, reports, memos	30	60
Objective test	30	70

GRADING CRITERIA

ASSESSMENT SYSTEM	ORDINARY EVALUATION	EXTRAORDINARY EVALUATION
Assessment of participation in class, exercises or projects of the course	10	10
Assessment of assignments, projects, reports, memos	40	40
Objective test	50	50

General comments on the evaluations/assessments

Participation will be assessed on the basis of attendance, active participation in class and the completion of the activities proposed during the course. This aspect will represent 10% of the final grade for the course.

Throughout the course there will be exercises and assignments (both individual and group) that must be submitted through the virtual platform. This work will account for 40% of the final grade for the course. Late submission of these assignments will result in a penalty in the grade. It will not be allowed to hand in any activity more than one week late.

In the middle of the term (November) there will be an exam of the first partial exam, which will be released if the student so wishes, on the condition that he/she obtains at least a grade of

4.0 in the exam. Those students who do not pass this grade or who decide to voluntarily discard it, must take the exams corresponding to the two mid-term exams on the date assigned for the ordinary call. The two mid-term exams will represent 50% of the final grade in the ordinary call.

In order to pass the course in the ordinary call, it is essential that the final grade is at least 5. Furthermore, the average of the mid-term exams must be at least 5, where the grade of each mid-term exam must be equal or higher than or equal to 4.

It is also necessary to have more than 80% of attendance to the classes of the subject in order to take the ordinary evaluation.

If a pass mark is not achieved in the ordinary evaluation session, the student may sit the extraordinary evaluation session in July. In this, the evaluation weights are maintained. In this call, students will have the opportunity to hand in the pending course work, in addition to the compulsory exam.

Any detection of plagiarism, copying or use of malpractice (such as the use of AIs) in a paper or exam will result in the failure of that paper with a zero, a report to the faculty and academic coordinator and the application of the current regulations, which can lead to very serious penalties for the student.

In the exams, the use of notes or programmable scientific calculators is not allowed, for which the student must refer to the specific instructions of the teacher on this subject.

Grades of any kind will not be retained between different academic years.

LIST OF REFERENCES (BOOKS, PUBLICATIONS, WEBSITES):

Key references

Matemáticas para videojuegos en 3D. Eric Lengyel. 2ª ed. Cengage Learning. 2011. ISBN: 978-6074815078

Physics for Game Programmers. Grant Palmer. Apress, 2005. ISBN: 978-1590594728. Álgebra y Geometría; E. Hernández. Addison-Wesley y Ed. U.A.M., 1994. ISBN: 978- 1590594728

Física I, Paul A. Tipler. Editorial Reverté. ISBN: 8429143661.

Recommended references

Physics for Game Developers: Science, math, and code for realistic effects. David M Bourg and Bryan Bywalec. 2013. 2ªed. 978-1449392512.

Getting Started with Processing. Casey Reas and Ben Fry. Published June 2010, O'Reilly Media.

Álgebra lineal y geometría cartesiana; J de Burgos. Segunda edición, McGraw-Hill, Madrid, 2000.

REQUIRED MATERIALS, SOFTWARE AND TOOLS

Type of classroom
Projection equipment and whiteboard

Materials:
Laptop computer

Notebook or tablet to take notes.

Software:

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