

# Course guide

## 200253 - MTD - Mathematics of Digital Technologies

Last modified: 09/06/2023

**Unit in charge:** School of Mathematics and Statistics  
**Teaching unit:** 749 - MAT - Department of Mathematics.

**Degree:** BACHELOR'S DEGREE IN MATHEMATICS (Syllabus 2009). (Optional subject).

**Academic year:** 2023    **ECTS Credits:** 3.0    **Languages:** Catalan

### LECTURER

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**Coordinating lecturer:** ANTONIO SUSIN SANCHEZ

**Others:** Primer quadrimestre:  
ANTONIO SUSIN SANCHEZ - M-A

### REQUIREMENTS

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Have passed the 2nd year of Degree

### TEACHING METHODOLOGY

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Project-based learning

### LEARNING OBJECTIVES OF THE SUBJECT

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Applications of mathematics to different fields of technology.  
Mastery of programming and numerical methods.

### STUDY LOAD

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Type	Hours	Percentage
Hours large group	15,0	20.00
Self study	45,0	60.00
Hours small group	15,0	20.00

**Total learning time:** 75 h



## CONTENTS

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### MATHEMATICS OF DIGITAL TECHNOLOGIES

**Description:**

Topic 1: Images and videos

Images as 2D and 3D matrices. Image processing based on transformations and derivation.

Volume models of medical images (TAC and MRI), segmentation by isosurfaces. Nets

neurons in images. Videos as temporal evolution of images. Video creation

of mathematics animation.

Topic 2: Computer graphics and 3D models

Definition of the topology of a 3D model. Editing and simplification of meshes of triangles or tetrahedrons.

Screen representation of a 3D model. Concepts of lighting and camera placement

in a scene 3D printing models and formats.

Theme 3: Animation based on Physics

Simulation of real-world physics on a computer. Particle systems: deformable objects versus rigid objects. Collisions between

objects. Simulation of fluids with particles.

Topic 4: Virtual and augmented reality

Creation of scenes for virtual reality devices. Animation of objects and characters.

Interaction with virtual objects. Augmented reality concept and applications.

**Full-or-part-time:** 2h

Theory classes: 2h

## GRADING SYSTEM

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Qualification of the projects

## BIBLIOGRAPHY

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**Basic:**

- Erleben, Kenny; Sporring, Jon; Henriksen, Knud; Dohlmann, Henrik. Physics-Based animation. Charles River Media, 2005. ISBN 1584503807.

## RESOURCES

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**Other resources:**

Computer graphics (<http://www.opengl-tutorial.org/>) />Image processing (<https://web.stanford.edu/class/ee368/>) />Matlab (<https://www.mathworks.com>) />Unity (<https://www.unity.com>) />Python (<https://www.python.org>)