

SUBJECT TEACHING GUIDE

G685 - Computer Graphics and Virtual Reality

Degree in Computer Systems Engineering

Academic year 2022-2023

| 1. IDENTIFYING DATA | | | | | |
|----------------------------------|---|------------------|--------------------|------------------|------------------|
| Degree | Degree in Computer Systems Engineering | | | Type and Year | Optional. Year 4 |
| Faculty | Faculty of Sciences | | | | |
| Discipline | Subject Area: Computing Mention in Computing | | | | |
| Course unit title and code | G685 - Computer Graphics and Virtual Reality | | | | |
| Number of ECTS credits allocated | 6 | Term | Semester based (1) | | |
| Web | https://moodle.unican.es/course/view.php?id=12153 | | | | |
| Language of instruction | Spanish | English Friendly | Yes | Mode of delivery | Face-to-face |

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|------------------|---|--|--|--|--|
| Department | DPTO. MATEMATICA APLICADA Y CIENCIAS DE LA COMPUTACION | | | | |
| Name of lecturer | ANDRES IGLESIAS PRIETO | | | | |
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| Office | E.T.S. de Ingenieros de Caminos, Canales y Puertos. Planta: + 1. DESPACHO PROFESORES (1024) | | | | |
| Other lecturers | | | | | |

| 3.1 LEARNING OUTCOMES |
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| - Acquisition of knowledge and skills necessary for the student to deepen computer graphics autonomously. |
| - Understanding the basics of the main methods of computer graphics, and possible ways of implementation and their effects on the virtual scenes. |
| - Knowledge about how do the main graphics packages actually work, their advantages and limitations, as well as their possible applications in the professional arena. |
| - Knowledge of what is the purpose of computer graphics and what are the pillars on which this discipline is settled. |
| - Knowledge of different techniques to achieve realism in three-dimensional images. |

4. OBJECTIVES

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| Learning and understanding the basic concepts and techniques in computer graphics. |
| Knowing the major graphical formats and industry standards of computer graphics, their scope and main advantages and disadvantages. |
| Understanding the basics of computer graphics, the graphics pipeline and use of the software and hardware applied to this field. |
| Knowing the history of computer graphics since its inception, as well as the historical evolution of the different methods in this field depending on the software and hardware available at any time. |
| Understand the use of the Graphical User Interfaces present today in many programs and operating systems from the viewpoint of computer graphics. |
| Gain enough knowledge to design algorithms for the most common geometric entities in computer graphics and make their implementation in a programming language. |

6. COURSE ORGANIZATION

CONTENTS

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| 1 | Part I. INTRODUCTION TO COMPUTER GRAPHICS. Introduction to the subject. Basic bibliography. Applications of computer graphics. Relevant examples and scope. History of Computer Graphics. Information sources: magazines, books, CDs, websites. Hardware and Software for Computer Graphics. Free and commercial software. Structure of the course. Basic Algorithms for Computer Graphics. Computer Lab Module 1: Line Algorithms. (I) Slope Intercept (basic and advanced); (II) DDA; (III) Bresenham's Algorithm. |
| 2 | Part II. 2D GRAPHICS. Basic algorithms for 2D graphics. 2D transformations. Transformation matrices. Computer Lab Module 2: 2D Transformations. (IV) 2D basic transformations; (V) application to 2D computer animation. Fractals. IFS. Computer Lab Module 3: Fractals. (VI) recursive fractals; (VII) Julia fractal sets; (VIII) Mandelbrot fractal sets; (IX) IFS; (X) application of the iterated function systems. L-systems. Simulation of natural phenomena. Computer Lab 4: L-systems. (XI) L-systems generation; (XII) applications of L-systems. |
| 3 | Part III. 3D GRAPHICS AND VIRTUAL REALITY. 3D transformations. Projections and perspectives. Representation systems. Polygon models: wire-frame, faces and vertices, etc. Basic models of lighting. Virtual and augmented reality. Concept, techniques and devices. Uses and applications. |

7. ASSESSMENT METHODS AND CRITERIA

| Description | Type | Final Eval. | Reassessn | % |
|---|--------|-------------|-----------|---------------|
| Computer lab training (95%). There is no exam in this subject. | Others | No | Yes | 95,00 |
| Written work on virtual reality (5%). | Work | No | Yes | 5,00 |
| TOTAL | | | | 100,00 |
| Observations | | | | |
| The evaluation will comply with the regulations of the University of Cantabria on copyright and plagiarism situations. All material used that is not of own elaboration must be properly identified and cited, with clear mention of the original source of the material. | | | | |
| Observations for part-time students | | | | |
| Part-time students unable to attend the classroom activities can ask for alternative assignments for assessment of such activities. | | | | |

8. BIBLIOGRAPHY AND TEACHING MATERIALS

BASIC

David F. Rogers, J. Alan Adams: "Mathematical Elements for Computer Graphics". MacGrawHill (1995).

A. Rockwood, P. Chambers: "Interactive Curves and Surfaces. A Multimedia Tutorial on CAGD". Morgan Kaufmann, San Francisco (1996).

R.S. Ferguson: "Practical Algorithms for 3D Computer Graphics". AK Peters, Massachussetts (2001).

James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes: "Computer Graphics: Principles and Practice" (2nd ed). Addison-Wesley, Reading, Mass (1992).

David F. Rogers: "Procedural Elements for Computer Graphics". MacGrawHill (1998).