COURSE DATA

Data Subject	
Code	36482
Name	Computer graphics
Cycle	Grade
ECTS Credits	6.0
Academic year	2022 - 2023

Study (s)

Degree	Center	Acad. year	Period
1407 - Degree in Multimedia Engineering	School of Engineering	2	Second term

Subject-matter

Degree	Subject-matter	Character
1407 - Degree in Multimedia Engineering	14 - Gráficos y Audio por Computador	Obligatory

Coordination

Name	Department
GIMENO SANCHO, JESUS	240 - Computer Science

SUMMARY

The course Computer Graphics is part of the audio material Computer Graphics and whose overall aim is to introduce students to the fundamentals that support and the basic techniques used in the generation of bi-and three synthetic images in graphics applications. It is a compulsory subject that is taught quarterly basis in the second year of the degree of Bachelor in Multimedia Engineering during the second quarter. The curriculum consists of a total of 6 ECTS.

The course is twofold in both theoretical and practical content to generate graphical and audio manipulation. Need to expose students to the theoretical basis on which these techniques are based to be able to cope with problems or unforeseen contingencies in the tools and libraries available. Moreover, it is imperative that students become familiar through practice, with standard forms of work in these fields using one of the most used tools and libraries that exist to generate charts.

The student should be able to not only manage the technical vocabulary of these fields and to evaluate and argue pros and cons of using various techniques presented, and use the contents presented in the problem solving approach and proposed. In this regard the oral presentations of proposed topics and sessions of problems in this group are intended to assist the student in the task of synthesis, abstraction and understanding necessary for the proper assimilation of the content.

The dynamics of the class is participatory. In the exposure classes of content, establishing a student-teacher dialogue and student-student through formulation of issues by both the teacher and the student. The kinds of problems, will develop activities that encourage group discussion and oral presentation by students. In laboratories will consider the development of small group work and presentation to the teacher / aa preferably through a dialogue that promotes a reasoned explanatory argument. The tutoring sessions are voluntary but are an important part of the accommodation the student to the dynamics of the subject and is the place not only answer specific questions about the concepts presented, but also to raise any problem or difficulty focusing staff arises regarding any aspect of the subject.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

There are no specified enrollment restrictions with other subjects of the curriculum.

Other requirements

The course has a direct bearing upon the subject of the matter to be taught in the first semester: Foundations of Computer Graphics and assumes the correct acquisition of the skills taught there. Also as recommended in this course have completed the courses Computer Programming and Mathematics I and II. The first two serve to equip students with skills in the use of libraries and coding programs. The last two give the student the ability to understand the geometric problems and use mathematical formalism t

OUTCOMES

1407 - Degree in Multimedia Engineering

- G1 - Be able to relate and structure information from different sources and to integrate ideas and knowledge. (RD1393/2007)
- G2 - Have the learning skills needed to undertake further studies or to gain further training with a certain degree of autonomy. (RD1393/2007)
- G3 - Take into account the economic and social context in engineering solutions, be aware of diversity and multiculturalism and ensure sustainability and respect for human rights and equality between men and women.
- G4 - Be able to integrate into working groups and collaborate in multidisciplinary environments and be able to communicate properly with professionals from all fields.
- G5 - Be able to lead working groups properly, respect and appreciate the work of others, take into account the needs of the group and be available and accessible.
- I2 - Know, design and make an efficient use of the data types and data structures that are most suited to solving a problem.

- MM1 - Have knowledge and ability to understand essential facts, concepts, principles and theories related to multimedia systems including all the disciplines covered by these systems.
- MM2 - Be able to understand and manage the different technologies involved in multimedia systems, both from the point of view of hardware and electronics and of software.
- MM3 - Be able to implement methodologies, technologies, processes and tools for the professional development of multimedia products in a real context of use by applying the appropriate solutions for each environment.
- MM5 - Know how to apply the theoretical and practical resources to deal with a multimedia application as a whole.
- MM7 - Be able to apply the principles of audiovisual graphic design and communication to multimedia products.
- MM8 - Integrate knowledge of different multimedia technologies to create products that offer global solutions that are appropriate to each context.
- MM9 - Program correctly in the different specific languages of multimedia systems taking into account time and cost restrictions.
- MM10 - Be able to analyse and integrate software components to develop multimedia applications.
- MM11 - Have knowledge and ability to apply the different mechanisms and elements to create both linear and non-linear audiovisual stories according to different production formats, technologies and media.
- MM12 - Know current 2D and 3D graphic systems and their application to multimedia developments.
- MM13 - Know and be able to use the techniques of digital audio and directional audio systems that can be integrated into multimedia applications.
- MM15 - Be able to respond professionally to the requirements at each step of a multimedia production process: show skills for preparing and understanding scripts and communication, graphic design for communication, management of streaming technology, web design and production and post-production processes.

LEARNING OUTCOMES

The direct learning outcomes will be:

1. Distinguish and locate the different processes that take place in the generation of graphs within the model of the graphic pipeline.

2. Develop the ability and intuition in bi and three-dimensional geometry and to think about problems visually as a means to support the search for a solution.

3. Know the common structure and basic that has a graphic library as well as identify and manage the types of data structures used in the generation of graphics.

4. Create graphical applications that are able to create visual communication between a program and the users of the same emphasizing the quality of communication or presentation that the graphics are capable of generating.

5. Use a graphic library to develop graphical applications that can be integrated into other computer applications

6. Know the basic structure of a program that interacts with the user.

7. To be able to choose according to the concrete graphical application, the most suitable algorithms for some of the processes of the graphic line

8. Diagnose and identify the process or processes involved in the failure or misbehavior of a graphic application

9. Develop graphic applications of visual, audio and interactive professional quality.

10. Get the most out of a standard graphic library

11. Characterize the different tools of design and generation of graphs by their functionalities

12. Characterize and know the constituent parts of the different types of graphic applications (data visualization, realistic images, games, real-time applications, ...)

13. To know the operation and, where possible, the use of interactive peripheral devices in graphic applications with audio

14. Encourage and develop the capacity of group work and the division of the same into specialized teams.

15. Be able to organize and communicate results and procedures about the scope of knowledge of computer graphics

In addition to the specific objectives mentioned above, the course will encourage the development of several generic skills, among which include:

1. Capacity for analysis and synthesis.

2. Ability to argue from rational and logical criteria.

3. Ability to communicate properly and organized.

4. Ability to develop a problem in a systematic and organized.

5. Ability to work and personal time distribution.

6. Ability to work in groups.

DESCRIPTION OF CONTENTS

1. Basic Rendering and Local Lighting

Basic Interaction Light and Matter. Computational Color Representation
Types of Local Illumination
Shading & texturing
Rendering and GPU-based shaders

2. High Level Graphical Structures

Display cost factors.
Optimization techniques.
Advanced Graphical structures.
3D graphics formats.

3. Global Lighting Models

Model of light radiation.
Optical approximation, ray-tracing.
Thermodynamic approximation, radiosity.

4. Advanced Geometrical Modelling

Surface Model Representation
Spatial partitions
Fractals and Generative Grammars.

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
Development of group work	4,00	0
Development of individual work	4,00	0
Study and independent work	12,00	0
Readings supplementary material	5,00	0
Preparation of evaluation activities	5,00	0
Preparing lectures	25,00	0
Preparation of practical classes and problem	15,00	0

Resolution of case studies	20,00	0
TOTAL	**150,00**	

TEACHING METHODOLOGY

This subject will follow a methodology based in flipped classroom, learning based in problems and learning based in projects.

With the aim of reducing the quantity of hours of masterclasses, the professors will make available the necessary materials to prepare theoretical classes. These materials will include: slideshows, videos and additional resources (scientific papers, book chapters, etc.). During the class debates will be proposed and the professor will resolve the doubts. Also the professor will explain the contents in the manner of masterclass if necessary.

During the classes of problems, real problems will be presented, related to the theoretical contents worked, so the students can develop a suitable solution. The students will work individually or in groups, depending on the problem.

During the practical sessions, the students will work to develop projects, where they can practice the theoretical contents. Finally, they will develop a final project including all the contents previously worked.

EVALUATION

For the evaluation of the course the following aspects will be considered.

(C) Continuous assessment, based on participation and the degree of involvement on the teachinglearning process. The attendance on regular basis to on-campus lectures/activities will be taken into account. A set of activities consisting of individual and group work to do at home or in class, oral presentations, resolution of issues and problems in class, and some partial individual tests may be conducted during the course. These exercises may be proposed without previous notice. The activities of continuous assesment cannot be retaken.

(E) There will be a final individual test consisting of one or more written exams or test of knowledge. These tests will consist of both theoretical questions and practical problems.

(P) Assessment of practical activities based on the achievement of objectives in the laboratory sessions and problems and a final work.

The final mark is calculated as follows:

Final Mark = 0.2 * C + 0.5 * E + 0.3 * P

A minimum of 5 (over 10) in parts E and P is required in order to calculate the Final Mark.

In the second call, note of the continuous assessment (C) and parts (E and P)

Approved will be kept. For unapproved parts (E and P) will be an exam, calculating the final mark as you would at first call.

REFERENCES

Basic

- Computer Graphics. Foley, Van Dam, Feiner, Hughes. Addison-Wesley. 2nd. Edition . 1995
- Gráficos por computadora con Opente. Hearn&Baker. Prentice Hall. 2006
- Interactive Computer Graphics. Edwar Angel. Addison Wesley.2001
- Computer Graphics and Virtual Environments. Slater M., Steed, A., Chrysantou Y.
- Lighting for animation, the art of visual storytelling. P. Jasmine Katatikarn & Michael Tanzillo. Ed. CRC Press.