VNIVERSITAT DE VALÈNCIA

Course Guide
36478 Graphics cards programming

COURSE DATA

Data Subject	
Code	36478
Name	Graphics cards programming
Cycle	Grade
ECTS Credits	6.0
Academic year	2021 - 2022

Study (s)

Degree	Center	Acad. year	Period
1407 - Degree in Multimedia Engineering	School of Engineering	4	Second term

Subject-matter

Degree	Subject-matter	Character
1407 - Degree in Multimedia Engineering	19 - Optatividad	Optional

SUMMARY

The course “Programming on Graphics Cards” is a core course of the fourth year of the Multimedia Engineering Degree. The course workload is 6 ECTS and it is given in the first four-month period of the second year.

This course is a continuation of the subjects "Computer Graphics" and "Advanced Graphics and Sound", which will delve into the programming graphics cards to generate real-time graphics. Likewise, students will also learn how to program such cards for general purposes.

PREVIOUS KNOWLEDGE

Relationship to other subjects of the same degree

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

Other requirements

Have completed and passed the subjects "Fundamentals of Computer Graphics" and "Computer Graphics"

OUTCOMES

1407 - Degree in Multimedia Engineering

- G2 - Have the learning skills needed to undertake further studies or to gain further training with a certain degree of autonomy. (RD1393/2007)
- 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.
- MM9 - Program correctly in the different specific languages of multimedia systems taking into account time and cost restrictions.
- MM28 - Be able to solve problems with initiative, decision-making and creativity and to communicate and transmit the knowledge, abilities and skills of a multimedia engineer.

LEARNING OUTCOMES

Learning goals of the course:

To Know the internal architecture of the graphic hardware.

Build small programs that use the graphic hardware to perform sophisticated visual effects.

Use the parallel programming and the graphic hardware for General-Purpose Computing.

It is also pretended in this course to further develop the following skills:

Logical reasoning.

Analysis and synthesis.

Oral and written communication skills.

Personal work capacity.

Teamwork and group leadership skills.

DESCRIPTION OF CONTENTS

1. Introduction

Review of OpenGL Basics
Historical evolution of the graphics cards architecture

2. Shader Programming Model

Motivation
Programmable Pipeline
High-level shading languages
GLSL API

3. Programming advanced lighting effects

Reflection and refraction
Local lighting models
Shadows

4. Efficient methods for real-time

Tessellation shaders
Geometric shaders
Compute shaders: Programming the graphics card for general purpose

WORKLOAD

ACTIVITY	Hours	% To be attended
Theory classes	30,00	100
Laboratory practices	20,00	100
Classroom practices	10,00	100
TOTAL	60,00	

TEACHING METHODOLOGY

Theoretical activities.

Description: The lectures will present the course contents providing a global vision, a detailed analysis of the key concepts and encouraging the student participation. The workload of this section for the students is 20% of the total of the course.

Practical activities.

Description: The practical activities complement the theoretical classes and allow the students to put into practice the contents and improve the understanding of the course concepts. They include the following types of classroom activities:

• Solving problems in class.
• Regular discussion of exercises and problems that the students have previously tried to work out.

• Laboratory sessions.

• Support tutorial sessions (individualized or in group).

• Individual evaluation of questionnaires to be done in class with the help of professors.

The workload of this section for the students is 30% of the total of the course.

Personal work.

Description: It is the work that the student must carry out individually out of the classroom timetable. It tries to promote the autonomous work habit. Activities in this group are: monographs, guided literature search, exercises and problems as well as preparation of classes and exams. The workload of this section for the students is 50% of the total of the course.

During the course the e-learning (pizarra virtual) platform of the University of Valencia will be used to support the teaching activities. This platform allows the access to the course materials used in the classes as well as additional documents, solved problems and exercises.

EVALUATION

The breakdown of the course assessment is the following:

(C) Continuous assessment. It is based on participation and the degree of involvement in the teaching-learning process. In this section it will be taken into account the attendance to classroom activities and the resolution of exercises and problems. The weight of this part will be 10% of the final mark. They are not recoverable in 2nd examination session.

(P) Laboratory activities assessment. The marks of this part will take into account the achievement of objectives in the laboratory sessions. These activities will be carried out individually and/or in-group and its weight is 45% of the final mark. They are not recoverable in 2nd examination session.

(T) Final Work, consisting of programming a final project and presentation of the work done

The final mark of the course in the first examination session will be calculated as follows:

$$M= 0,2*C + 0,4*T+ 0,4* P$$

Part (C) and (D) will be replaced in the 2º examination session by an exam , and the final mark of the course in the second examination session will be calculated as follows:

M = 0, 5*T + 0,5* E

In any case, the evaluation of this subject will be done in compliance with the University Regulations in this regard, approved by the Governing Council on 30th May 2017 (ACGUV 108/2017)

REFERENCES

Basic

- Red book OpenGL Programming guide, 8th Edition. D Shreiner. Addison-Wesley, 20103.
- Graphics Shaders. Theory and Practice (2nd edition). Mike Bailey & Steve Cunningham. CRC Press, 2012.

Additional

- OpenGL 4 Shading Language Cookbook, 2nd Edition. David Wolff. Packt Publishing Ltd, 2013.
- Real-Time Rendering, 4th Edition. T. Akenine-Möler, E. Haines, N. Hoffman. A K Peters/CRC Press, 2018.
- Mathematics for 3D Game Programming and Computer Graphics, 3rd Edition. Eric Lengyel. Course Technology PTR, 2012.

ADDENDUM COVID-19

This addendum will only be activated if the health situation requires so and with the prior agreement of the Governing Council

If it is required by the sanitary situation, the Academic Committee of the Degree will approve the Teaching Model of the Degree and its adaption to each subject, establishing the specific conditions in which it will be developed, taking into account the actual enrolment data and the space availability.