Pla Docent de l'Assignatura

Guia Docent

Nom de l'assignatura: **Visualització Avançada (a.k.a. Computer Graphics)**

Curs acadèmic: 2012-2013 **Curs:** Quart **Trimestre: Primer**

Estudis: Grau en Enginyeria en Sistemes Audiovisuals (Obligatòria)

Codi assignatura: **21622**
Nombre de crèdits ECTS: 4
Nombre total d'hores de dedicació: **100 hores**
Llengua o llengües de docència: **English**
Professorat: **Arash Bahrehmand, Josep Blat**
Professorat responsable: **Josep Blat**

1. Dades descriptives de l'assignatura

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2. Presentació de l'assignatura

Currently, a large part of the visual material in movies is synthetically generated – even more in animation movies; this material is usually denoted as CGI. Computer graphics is also the key component of videogames. It is also very important in several other fields such as Scientific & Medical visualization, in GIS (Geographical Information Systems), Industrial design, Simulation, or Communication at large.

The goal of this *assignatura* is to introduce computer graphics, especially with respect to *Audiovisual* (Media) systems.

The topic has not been introduced before this fourth and final year of the degree. It is probably the first and last time the topic is dealt with within the degree. The goal of the *assignatura* will be to provide an introduction to the subject of computer graphics, but also to enable the future *enginyer/es en sistemes audiovisuals* to be able to manage basic graphics engineering within media systems.

From the acquired and necessary skills point of view, another aspect that has to be taken into account is that the overwhelming majority of the programming that students have carried out so far in the degree is through MatLab. Introducing C++ and OpenGL is both a challenge and an objective of the course, so that students acquire the basics of a technical competence, which will be probably important for their professional future. Enabling the students to deal with high-level industrial graphics packages (such as Maya) is another objective, to be achieved in terms of students implementing interesting CG plug-ins for Maya.

3. Competències a assolir a l'assignatura

Competències a treballar a l'assignatura segons l'indicat en el pla d'estudis del grau.

Competències transversals	Competències específiques
Instrumentals G1. Capacitat d'anàlisi i síntesi G2. Capacitat d'organització i planificació G7. Capacitat de comunicar-se en contextos acadèmics i professionals de forma oral i escrita en anglès, tant davant audiències expertes com inexpertes ***Sistèmiques*** G12. Capacitat per a progressar en els processos de formació i aprenentatge de manera autònoma i contínua G14. Capacitat de motivació per la qualitat i per l'assoliment	***Competències Específiques Professionals*** H2. Disposar dels fonaments matemàtics, físics, econòmics i sociològics necessaris per interpretar, seleccionar, valorar, i crear nous conceptes, teories, usos i desenvolupaments tecnològics relacionats amb la informàtica, i la seva aplicació. H4. Aprendre de manera autònoma nous coneixements i tècniques adequats per a la concepció, el desenvolupament o l'explotació de sistemes informàtics. B16. Conèixer els fonaments teòrics de la programació i utilitzar de forma pràctica els mètodes i llenguatges de programació per al desenvolupament de sistemes software. ***Competències Específiques d'Enginyeria en Sistemes Audiovisuals*** AU20. Assolir els coneixements bàsics de les tècniques de traçat de rajos, del modelatge geomètric i de la generació d'imatges sintètiques

4. Continguts

Theory contents

1- Modeling and representation of 3D objects for CG
2- Graphics pipeline, geometry, object-light interaction and rendering
3- Mapping techniques
4- Global Illumination models: introduction to ray tracing & radiosity
5- Geometric Shadows
6- Basics of Computer Animation
7- Selected advanced topics

***Lab* contents**

The seminars and labs will provide practical introductions of C++ and OpenGL as well as to practical approaches to key basic issues in Computer Graphics through professional packages.

There will be two major projects (one related to OpenGL and the other one to Maya, based on some reference provided) and several assignments (related to C++, and OpenGL). Examples of the assignments and projects are:

1- Creating and visualizing some primitive shapes, and interacting with them
2-Apply materials to shapes, introducing different light sources and visualizing differences (shading effects)
3-An advanced topic, such as: Bump mapping, Ray tracing & Radiosity, Animation and collision simulation
4-Scripting for a CG package - Maya

5. Avaluació del nivell d'assoliment de les competències

The evaluation will be made on the material delivered, as requested in the sessions of theory, seminars, and labs (reports, source code fully commented) – see the Aula Global for further information.

The evaluation will be carried out after the delivery of the material, including personal interviews if appropriate, and feedback to the students will be provided.

The assignments and project delivered by the end of week 7 will make up 50% of the mark; the rest of the assignments and project will be another 50% of the mark.

If some part of the work is failed, it can be re-submitted before the marks delivery in December, with a personal interview - or in the established 'resubmission' period in July, again with a personal interview.

6. Bibliografia i recursos didàctics

The main textbook is:

Watt, Alan H.: *3D Computer Graphics*, Addison-Wesley, Harlow, 2000 (3rd ed.) T385 .W38 2000

Another interesting book, more oriented to programming is:
Buss, Samuel R.: *3D Computer Graphics: A mathematical approach with OpenGL*, Cambridge University Press, Cambridge, 2003

Other material will be provided in lectures, seminars and labs through the Aula Global.

7. Metodologia

The organization of the course is based on the interplay of theory, seminars, and labs. During the theory plenary sessions the basic concepts of Computer Graphics will be introduced, together with discussing both mathematical (geometrical) grounding, and computing aspects. During seminars, deeper insights of the computing aspects (programming, data structures) are discussed, together with complementary material related to software. During labs, the focus is on the (computing) outcomes.

As indicated in the beginning, the computing aspects are the focus of the course. The course intends to complement the fundamentals in programming graphics with C++, as well as the OpenGL API, and providing the basics of scripting in the framework of industry standard software such as Maya.

8. Programació d'activitats

- Programació de sessions presencials

	Dimarts 16.30-18.30	**Dijous 18.30-20.30**	**Divendres 14.30-16.30**
1 **24-28 set**	**25/09** **T1**	**27/09**	**28/09** S101/ S102 (1h cada grup)
2	**02/10** **T1**	**04/10** P101	**05/10** S101/ S102

1-5 oct			(1h cada grup)
3 **08-12 oct**	**09/10** **T1**	**11/10**	**12/10** **FESTIU**
4 **15-19 oct**	**16/10** **T1**	**18/10** P101	**19/10** S101/ S102 (1h cada grup)
5 **22-26 oct**	**23/10** **T1**	**25/10**	**26/10** S101/ S102 (1h cada grup)
6 **29 oct-2 nov**	**30/10** **T1**	**01/11** **FESTIU**	**02/11** **NO LECTIU**
7 **5-09 nov**	**06/11** **T1**	**08/11** P101	**09/11** S101/ S102 (1h cada grup)
8 **12-16 nov**	**13/11** **T1**	**15/11**	**16/11** S101/ S102 (1h cada grup)
9 **19-23 nov**	**20/11** **T1**	**22/11** P101	**23/11** S101/ S102 (1h cada grup)
10 **26 -30 nov**	**27/11**	**29/11**	**30/11** S101/ S102 (1h cada grup)
11 **3 – 4 des**	**04/12** P101	**06/12**	**NO LECTIU**