Course Syllabus

Course Name **Computer Graphics**	*Course No.* **CO19-320322**	*ECTS* **5**
Course Affiliation(component of module…) CO19-ApplCS Applied Computer Science	*Pre-requisites* CH08-GenCS	*Level* Year 1 ☐Fall ☐Spring Year 2 ☒Fall ☐Spring Year 3 ☐Fall ☐Spring Jacobs Track ☐Fall ☐Spring

Course Description / Content/ Aims

Computer graphics deals with the digital synthesis and manipulation of visual content, typically embedded in a three-dimensional scene. Prominent tasks in computer graphics are geometry processing, rendering, and animation. Geometry processing is concerned with object representations such as surfaces and their modeling, rendering is concerned with simulating light transport to get physically-based photorealistic images of 3D scenes or applying a certain style to create non-photorealistic images, and animation is concerned with descriptions for objects that move or deform over time. This is an introductory course into the concepts and techniques of 3D (interactive) computer graphics. It includes mathematical foundations, basic algorithms and principles, and advanced methods and concepts.

Intended Learning Outcomes (ILOs)

Discipline Specific Skills

- Understands foundations of computer graphics (rendering, shading, lighting, textures)
- Can program graphics rendering engines using the Open Graphics Library (OpenGL)

Workload / Contact Hours			
Type (Lecture/Seminar/Lab)	**Number of Sessions** (per Semester)	**Duration** (minutes)	**Total** (hours)
Lecture	28	75	35
Private Study	-	-	70
Exam Preparation	-	-	20
	-	-	125

Element	**Duration**	**Weighting**
Final Examination	115 minutes	35%
Midterm Examination	70 minutes	20%
Homework Assignments	n/a	45%

Literature / Reading List

1. Donald Hearn & M.P. Baker: *Computer Graphics with OpenGL*, Prentice Hall International, ISBN 0130153907, 3rd edition, 2003.
2. Max K. Agoston: *Computer Graphics and Geometric Modeling*, Springer, 2005 (online available).
3. Alan Watt: *3D Computer Graphics*, Pearson - Addison Wesley, ISBN: 0201598559, 3rd edition, 2000.
4. Dave Shreiner, Mason Woo, and Jackie Neider: *OpenGL Programming Guide: The Official Guide to Learning OpenGL*, Addison-Wesley Longman, 3rd edition, 2006.

Course Schedule

Session	**Topic**	**Literature / Textbook Chapter**
1	Goals & Applications	Hearn et al. – Chapter 1
2	Geometric background – coordinate systems, transformations, projections	Hearn et al. – Chapter 4,7,9,10, Watt et al. – Chapter 1
3	Object representation - meshes	Hearn et al. – Chapter 3

4	Object representation - viewing to OpenGL	Shreiner et al.
5	Object representation – point clouds, surface reconstruction	n/a
6	Object representation – implicit surfaces	Hearn et al. – Chapter 13
7	Raster graphics – display, ray casting	Hearn et al. – Chapter 2,21, Watt et al. – Chapter 1
8	Raster graphics – scan convertion	Hearn et al. – Chapter 6
9	Raster graphics – polygon filling	Hearn et al. – Chapter 6
10	Raster graphics – anti-aliasing	Hearn et al. – Chapter 6
11	Raster graphics – visibility, culling	Hearn et al. – Chapter 6,8
12	Color models – light & human perception, RGB/RGBA/CMY models	Hearn et al. – Chapter 19, Watt et al. – Chapter 15
13	Color models – HSV/HLS model	Hearn et al. – Chapter 19, Watt et al. – Chapter 15
14	Color models – CIE models	Hearn et al. – Chapter 19, Watt et al. – Chapter 15
15	Illumination – Phong model, Blinn-Phong model	Hearn et al. – Chapter 17
16	Illumination – BRDFs	Hearn et al. – Chapter 17
17	Shading – flat, Gouraud, Phong	Hearn et al. – Chapter 22
18	Global illumination – ray tracing	Hearn et al. – Chapter 21, Watt et al. – Chapter 12
19	Global illumination – radiosity	Hearn et al. – Chapter 21, Watt et al. – Chapter 11
20	Global illumination – photon mapping	Hearn et al. – Chapter 21, Watt et al. – Chapter 10
21	Global illumination – shadow mapping, shadow volumes	Watt et al. – Chapter 9
22	Global illumination – environment mapping	Hearn et al. – Chapter 21
23	Textures – texture mapping	Hearn et al. – Chapter 18
24	Textures – bump mapping, displacement mapping	Hearn et al. – Chapter 18
25	Curved object representations – Bézier curves, B-spline curves, tensor product surfaces, triangular patches	Hearn et al. – Chapter 14, Watt et al. – Chapter 3
26	Curved object representations – subdivision surfaces	Hearn et al. – Chapter 14
27	Modeling – multiresolution methods	n/a
28	Animation	Hearn et al. – Chapter 12, Watt et al. – Chapter 17
	Final exam date to be determined.	

*to be additionally entered in CampusNet

Version (Date of Revision)
002 (05/2015)

Signature Program Coordinator

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Signature **Date**