

University of Macau
Faculty of Science and Technology
Department of Computer and Information Science
SFTW301 Computer Graphics
Syllabus
2nd Semester 2010/2011
Part A – Course Outline

Elective course in Computer Science

Catalog description:

(3-2) 4 credits. Study and implement computer graphics techniques. Topics include graphics systems and interactive techniques, graphics primitives, 2D/3D geometric and viewing transformations, clipping, projections, illumination models, and shading methods.

Prerequisites:

- MATH103
- SFTW241

Textbook(s) and other required material:

- Donald Hearn and M. Pauline Baker, *Computer Graphics with OpenGL*, 3rd Edition, Pearson Prentice Hall, 2004.

References:

- OpenGL Architecture Review Board, Dave Shreiner, Mason Woo, Jackie Neider, Tom Davis. *OpenGL Programming Guide: The Official Guide to Learning OpenGL, Version 3.0 and 3.1*, 7th Edition, Addison-Wesley, 2009.
- James D. Foley, Andries van Dam, Steven K. Feiner, John F. Hughes, *Computer Graphics - Principles and Practice*, 2nd Edition in C, Addison-Wesley, 1995.

Major prerequisites by topic:

- Analytic geometry and linear algebra.
- C/C++ programming.

Course objectives:

- To make students understand the basic concepts in computer graphics. [a]
- To teach students the basic techniques to model 3D objects. [a]
- To teach students the graphics rendering pipeline and methods to create the 3D virtual scene. [a]
- To teach students the illumination models and rendering techniques. [a]
- Learning to implement these techniques by OpenGL. [e, k, l]

Topics covered:

- **Graphics hardware and software, graphics applications (5 hours):** Introduce the basic concept and vocabulary of computer graphics, along with the overview of the hardware and software components of graphics systems. Introduce a plenty of computer graphics techniques and applications nowadays.
- **Graphics primitives and their attributes (5 hours):** Introduce the graphics output primitives and their attributes. Discuss the scan-conversion algorithms for displaying output primitives.
- **2D/3D geometric and modeling transformations (6 hours):** Study the 2D/3D transformations in matrix representations. Learn how to apply transformation operations to geometric models to reposition or resize them.
- **Graphics pipeline and 2D/3D viewing transformations (7 hours):** Introduce the concept of graphics pipeline. Discuss the procedures for displaying views of 2D and 3D scenes.
- **Illumination models and surface-rendering methods (5 hours):** Discuss the illumination models and methods for applying lighting conditions to a scene.
- **Texture mapping (2 hours):** Introduce the concept of texture mapping and related techniques.
- **OpenGL and GLUT programming (9 hours):** Study how to use OpenGL and GLUT to implement all these graphics concepts introduced.

Class/laboratory schedule:

Timetabled work in hours per week			No of teaching weeks	Total hours	Total credits	No/Duration of exam papers
Lecture	Tutorial	Practice				
3	1	1	14	70	4	1 / 3 hours

Student study effort required:

Class contact:	
Lecture	39 hours
Tutorial & practice	28 hours
Mid-term exam	3 hours
Other study effort	
Self-study	42 hours
Homework assignment	18 hours
Total student study effort	130 hours

Student assessment:

Final assessment will be determined on the basis of:

Assignment and programming practice	30%
Mid-term exam	30%
Final exam	40%

Course assessment:

The assessment of course objectives will be determined on the basis of:

- Assignment, programming practice and exams
- Course evaluation

Course outline:

Weeks	Topic	Course work
1	Introduction of Computer Graphics Computer graphics concept; Computer graphics applications	
2	Graphics Hardware and Software Systems Video display devices; Input devices; Graphics software and OpenGL	Assignment#1
3-4	Graphics Output Primitives Coordinate reference frames; Line-Drawing Algorithms; Points, lines, and polygons; OpenGL implementation and related functions	Assignment#2, Programming Practice#1
5	OpenGL and GLUT Programming OpenGL; GLUT	Programming Practice#2
6	Attributes of Graphics Primitives Color and gray scale; Points, lines, and fill-area attributes; OpenGL implementation and related functions	Assignment#3, Programming Practice#3
7-8	Geometric Transformations Translation, rotation, scaling, reflection and shear; Matrix representation and homogeneous coordinates; Inverse and composite transformation; OpenGL implementation and related functions	Assignment#4, Programming Practice#4
9	Midterm Exam	Programming Practice#5
10-11	2D Viewing 2D viewing pipeline; Clipping window; Normalization and viewport transformations; Clipping algorithms; OpenGL implementation and related functions	Assignment#5, Programming Practice#6
12	3D Viewing 3D viewing concepts and viewing pipeline; Projection transformations; Viewport transformation; OpenGL implementation and related functions	Assignment#6, Programming Practice#7

Weeks	Topic	Course work
13-14	Illumination Models and Surface Rendering Methods Light sources; Basic illumination models; Global illumination models; Texture mapping; OpenGL implementation and related functions Review	Assignment#7

Contribution of course to meet the professional component:

This course provides students the fundamental knowledge of computer graphics, which are necessary for their professional career in this field.

Relationship to CS program objectives and outcomes:

This course primarily contributes to the Computer Science program outcomes that develop student abilities to:

- (a) an ability to apply knowledge of mathematics, science, and engineering.
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- (l) an ability to use the computer/IT tools relevant to the discipline along with an understanding of their processes and limitations.

The course secondarily contributes to the Computer Science program outcomes that develop student abilities to:

- (e) an ability to identify, formulate, and solve engineering problems.

Relationship to CS program criteria:

Criterion	DS	PF	AL	AR	OS	NC	PL	HC	GV	IS	IM	SP	SE	CN
Scale: 1 (highest) to 4 (lowest)							2		1					

Discrete Structures (DS), Programming Fundamentals (PF), Algorithms and Complexity (AL), Architecture and Organization (AR), Operating Systems (OS), Net-Centric Computing (NC), Programming Languages (PL), Human-Computer Interaction (HC), Graphics and Visual Computing (GV), Intelligent Systems (IS), Information Management (IM), Social and Professional Issues (SP), Software Engineering (SE), Computational Science (CN).

Course content distribution:

Percentage content for			
Mathematics	Science and engineering subjects	Complementary electives	Total
0%	0%	100%	100%

Coordinator:

Prof. Yi Ping Li

Persons who prepared this description:

Dr. Wen Wu, Dr. En Hua Wu

Part B – General Course Information and Policies

2nd Semester 2010/2011

Instructor: Dr. Wen Wu
Office: N419
Office hour: by appointment
Phone: 8397 4469
Email: wenwu@umac.mo

Time/Venue: Tue 4:00 pm – 7:00 pm, WLG305 (lectures)
Sat 4:30 pm – 6:30 pm, T103 (tutorial)

Grading distribution:

Percentage Grade	Final Grade	Percentage Grade	Final Grade
100 - 93	A	92 - 88	A–
87 - 83	B+	82 - 78	B
77 - 73	B–	72 - 68	C+
67 - 63	C	62 - 58	C–
57 - 53	D+	52 - 50	D
below 50	F		

Comment:

This course is to provide students with a comprehensive introduction to 2D and 3D computer graphics techniques. These techniques are taught in learning by doing rather than theoretical. Students will write programs to test various concepts and techniques, and gain practical experience by OpenGL. A good knowledge of C/C++ programming is the prerequisite.

Homework and programming practice policy:

Learning by doing is an essential way to grasp the principles of the course.

- There will be approximately 7 homework assignments and 6 programming practice.
- No late homework and programming practice is accepted.
- No marks will be given in case of copying from others.

Mid-term exam:

The mid-term exam will be held during the semester.

Note:

- Reading the textbook is imperative.
- Check UMMoodle (<https://ummoodle.umac.mo/>) for announcement, lecture notes, homework and related resources.
- Cheating is absolutely prohibited by the university. Issues regarding the final exam follow the university rules and policies.