MASTER SYLLABI

MINNESOTA SCHOOL OF BUSINESS GLOBE COLLEGE TECHNICAL COURSE SYLLABUS

COURSE NUMBER: GD160

COURSE TITLE:

MATHEMATICES FOR 3D ANIMATION & GAMES

COURSE LENGTH: PREREQUISITES:

H: 12 WEEKS : GD155, Concurrent with SD400

CREDIT HOURS: CONTACT HOURS:

4 40 (LECTURE)

TEXT: <u>MATHEMATICS FOR 3D GAME PROGRAMING & COMPUTER GRAPHICS</u>, by Eric Lengyel, Charles River Media. **ISBN:** 1584500379

ESSENTIAL MATHEMATICS FOR COMPUTER GRAPHICS FAST, John Vince, Springer Verlag Publisher ISBN: 1-85233-380-4

COURSE DESCRIPTION: Students will learn mathematical models that underlie the design and construction of game engines and the various interactions specific to animated computer games and the techniques of calculation needed to apply them. Topics include coordinate transforms, interpolation, illumination, visibility, collisions and elementary physics. Exercises in this course require the student to be able to implement classes in the C++ programming language.

OBJECTIVES: Upon completion of this course the student will be able to:

- 1. To calculate transforms using rotation matrices and quaternions.
- 2. To implement calculations associated with the view frustum, to use interpolation for perspective and to project 3-deminsional scenes to 2-dimensional displays.
- 3. To apply ray tracing to generate light-maps, determine visibility and test for line of sight.
- 4. To implement various features of illuminations by using mathematical models.
- 5. To determine visibility by bounding volumes and by partitioning binary space.
- 6. To detect and resolve environmental and interobject collisions.
- 7. To apply polygonal modeling.
- 8. Utilities mathematical models from basic mechanics (elementary physics).

COURSE OUTLINE:

	Topic(s) & Class Activities	Required Reading	
Week #1	Analytic Geometry & Linear Algebra Review of vectors & matrices		
Week #2	Linear Algebra & Coordinate Transformations Using matrices for coordinate transformations	Lengyel,: Ch. 1-2.3	
Week #3	Quaternions & 3D Engines Using quaternions for coordinate transformations Lines & planes in 3-space, the view frustum, perspective-correct interpolation & projection matrices	Lengyel: Ch. 2.4-3.5	
Week #4	Interpolation & Ray Tracing Using linear & non-linear techniques of interpolation; Finding roots; calculating normal, reflection & transmission vectors.	Lengyel: Ch 5	

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MASTER SYLLABI Required Reading

Week #5	Mid-term (Ch. 1-5) & Illumination Color, light sources & diffuse lighting	Lengyel: Ch. 6-6.3
Week #6	Illumination Specularity, texture mapping, emission, shading, bump mapping, reflection & Cook-Torrance illumination	Lengyel: Ch. 6.4-6.6
Week #7	Determining Visibility Constructing & testing bounding volumes; Spatial partitioning by trees; zones & portals	Lengyel: Ch. 7
Week #8	Collisions, Curves & Patches Detecting collisions between objects & environment & between objects; B_zier curves, B-splines, continuity & surface patches	Lengyel: Ch 8
Week #9	Polygonal Techniques Depth-value offset, decals, bill boarding, stencils, shadowing & polygon reduction	Lengyel: Ch. 9
Week #10	Test (Ch. 6-9) & Linear Physics Position functions, projectile motion, resistance, terminal velocity & friction	Lengyel: Ch 10.1, 10.3-10.5
Week #11	Rotational Physics Angular velocity, centrifugal & Coriolis forces; Rigid bodies, angular momentum, torque & oscillatory motion	Lengyel: Ch. 11

Week #12 Review & Course Examination

Topic(s) & Class Activities

INSTRUCTIONAL METHODS: Class sessions will consist of instructor lectures, demonstrations, hands-on exercises, and drawing projects. Students will be assigned reading from required texts and instructor provided hand-outs.

EVALUATION METHODS:

All required assignments must be completed to obtain a passing grade in the course. All assignments are due on the date specified. Students must also have a satisfactory attendance record & grades may be modified for classroom participation.

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Students' grades will be based on the distribution of weights indicated below. The final grade for the course is based on the following percentages:

Source	Weight	Score	Grade
Exercises:	20.0%	100-90%	А
Test 1	20.0	89-80%	В
Test 2	20.0	79-70%	С
Course Examination	<u>40.0</u>	69-60%	D
		59% and lower	N/C
Total	<u>100.0%</u>		