Carleton University, Computer Science, Winter 2016

**Comp 4501 Advanced Computer Game Design and Development**

Course Outline

**Introduction**:

A quick review of some of the preliminaries that you should have had from other courses including a simple lighting model that we will make use of in the more advanced topics below and an understanding of shaders for sampling information from textures. We will make use of, design, and change very advanced shaders associated with OpenGL.

**Physics**

A discussion of physics engines such as the Bullet or Nvidia’s PhysX, not so much for the facilities they provide, but more for the notion of how to add it to your own game engine.

**Deferred Rendering**

The distinction between forward renders and deferred renderers, including the notion of multiple render targets (MRT), pre-lighting and post-lighting deferred renderers.

**Ambient Occlusion**:

What it is. Techniques for performing ambient occlusion including the development of shaders culminating in an advanced multi-resolution screen space ambient occlusion shader.

**Order Independent Transparency**:

Eliminating the need to capture and draw transparent objects in a special last pass.

**Relief Mapping**

 What it is. The notion of tangents space and how to map to and from this space along with the development of shaders that perform normal mapping, parallax mapping, relief mapping, and cone mapping.

**Water flow**:

Advanced ways of achieving water flow beyond the simple notion of scrolling texture coordinates.

**Shadow Mapping**

 Generating efficient shadows under the rubric “lights for shadows”.

**Lighting with Huge Numbers of Lights**

Why a dozen lights is not enough. The evolution of a practical shader for drawing hundreds of lights under the rubric “lights for coloring”. Pitfalls, solutions.

**Other Topics**

Occlusion culling, instancing, water shaders along with reflection and refraction, geometry shaders, mirrors and reflection for water, screen space reflection.