CS5820-Aug20: Graphical Processing Unit: Hardware and Software

Hardware Tentative items

- Introduction to 3D - evolution, abstraction of the graphics pipeline, journey of vertex to pixel
- The Graphics Pipeline
  - Vertex Fetch – vertex format, indexing
  - Vertex Shader – View Transforms, Projection, screen mapping
  - Rasterizer – walking algorithm, interpolation, depth testing
  - Pixel Shader – Barry co-ordinates, interpolation, color computation, lighting
  - Sampling – Textures, filtering
  - Pixel Output – Tiling, Blending, Multi sample, anti aliasing, Compression,
    coarse Pixel shading, render Target formats
  - Geometry Shading - Hull shading, Tessellation, Domain Shading

Some additional topics

  - VR techniques
  - Ray Tracing Fundamentals
- General Purpose GPU – fundamentals, systolic arrays, compute shading, Unordered Access View
- Power and Performance
- Assignments – Applying the above techniques to create certain effects in graphics, power/perf optimization, matrix math, graphics fundamentals

Software Tentative items

1. End to End Graphics Stack Overview
   a. Introduction of Userspace/Middleware, UMDs and i915 kernel
   b. Set up your own Linux environment
2. i915 Overview
   a. Overview of Display, GT, GEM
   b. Display: Need to reach out to suresh -- Kalyan
3. UMD Overview
   a. Mesa – Gallium Overview, iris, Vulkan driver introduction, Introduction of standards like Opengl, Vulkan
   b. Introduction of iHD - libva
   c. Introduction of Level 0 & NEO.
4. Tools, Tests and Debug Introduction

And each of the above topics will be followed by home assignment/lab assignment that can be used/modified to use as assessment of the students.
Books and references: Here are the recommendations of the books/contents:

1. Real time rendering by Moeller and Haines
2. Any other book on 3D graphics available out there
3. DX/OGL specs

Topic	Books Links
OpenGLES	• https://www.amazon.com/OpenGL-3-0-Programming-Guide-Edition/dp/0321933885/khongrou-2 latest edition • https://www.amazon.com/OpenGL-3-0-Cookbook-Parminder-Singh/dp/1849695520/khongrou-2 • https://www.amazon.com/dp/1794505148?creativeASIN=1794505148&linkCode=w61&imprToken=WE3cluDWM957fUvTztWptQ&slotNum 20
OpenGL	• https://www.amazon.com/gp/product/0321773039/khongrou-20 • https://www.amazon.com/OpenGL-Development-Cookbook-Muhammad-Movania/dp/18496950 • https://www.amazon.com/Computer-Graphics-Programming-OpenGL-Java/dp/1683920279/
EGL	• https://www.khronos.org/registry/EGL/

Webgl	• https://www.packtpub.com/game-development/webgl-beginners-guide • https://www.amazon.com/WebGL-Up-Running-Tony-Parisi/dp/144932357X/khongrou-20 • https://www.amazon.com/gp/product/0321902920/khongrou-20
GLSL	• https://www.amazon.com/gp/product/1568814348/khongrou-20 • https://www.amazon.com/OpenGL-Shading-Language-Randi-Rost/dp/0321637631 • https://www.amazon.com/OpenGL-Shading-Language-Cookbook-high-quality-ebook/dp/B07HX
Frame trace	https://github.com/janesma/apitrace/wiki/frameretrace-branch
GPA	https://software.intel.com/content/www/us/en/develop/tools/graphics-performance-analyzers.html