**SYLLABUS:**

**ChBE 6232 Chemical Engineering Processes in Pulp and Paper manufacture**

**Part 1: Advanced Pulping and Bleaching Processes**

*Instructior: Jeff Hsieh*

1. Raw Materials

cellulose, hemi-cellulose, lignin and extractives

1. Pulping Process Overview

mechanical pulping, chemical pulping – alkaline and sulfite pulping; hybrid pulping; pulping of nonwood fibers; non sulfur pulping; solvent pulping

1. Secondary Fiber Pulping

recycled fiber pulping and deinking

1. Bleaching Process Overview

chlorine bleaching; caustic extraction; hypochlorite bleaching; chlorine dioxide bleaching; bleaching of mechanical pulp

1. Non-Chlorine Bleaching

oxygen, peroxide and ozone bleaching; environmental aspects of bleaching

1. Emerging Pulping and Bleaching Processes

**Part 2: Chemical Recovery in Pulp Mills**

*Instructor: Pradeep K. Agrawal*

1. Recovery Processes in Sulfite Pulping

calcium-base recovery; magnesium-base recovery; ammonia-base liquor recovery; sodium-base liquor recovery; other sulfite recovery methods

1. Recovery of By-Products from the Sulfite Process

whole spent liquor and lignosulfonates; vanillin from sulfite spent liquor; alcohol from sulfite spent liquor; fermentation of sulfite spent liquor to produce protein

1. Liquor Recovery in Alkaline Pulping

evaporation of Kraft liquors; recovery furnace; recausticizing

1. By-Product Recovery

alkali lignin; sulfate turpentine; tall oil recovery in Kraft mills; other alkaline pulping by-products

**Part 3: Environmental Modeling**

*Instructor: Sujit Banerjee*

1. Estimation of Physico-Chemical Parameters
2. Modeling of Aerated Stabilization Basins
3. Design and Modeling of Wastewater Treatment Systems using Water 9

**Part 4: Papermaking Chemistry**

*Instructor: Yulin Deng*

1. KineticProperties and Optical Properties of Colloids

motion of particles in liquids; osmotic pressure; light scattering

1. Surface and Interface Properties

surface tension; contact angles, Young and Laplace equations; capillary rise and depression, Kelvin equation; measurement of surface tension; wetting and spreading; interfacial tensions; surfactants

1. Electrical properties of colloids

electrical double layer; electrokinetic phenomena; electrokinetic theory

1. Papermaking Wet-end Process and Additives

paper sizing; strength additives; fillers; forming and deforming