COURSE: CHEMISTRY 579, Surface and Colloid Chemistry for Engineers

MATERIAL TO BE COVERED:

(1) Introduction to colloids and surfaces
   - common colloidal systems
   - introduction and importance of common terms, e.g., specific surface area
   - review of free energies and chemical potentials

(2) Solid-gas interfaces
   - Crystallite face indexing and surface defects
   - Basic gas adsorption and the Langmuir isotherms
   - Empirical isotherms, IUPAC isotherm classification and isosteric heats of adsorption
   - Common industrial mesoporous solids
   - The BET isotherm and mesopore volume distribution
   - Exercise 3 – drying a high-pressure CO₂ stream

(3) Kinetic and statistical forces – particle and continuous phase
   - External forces and drift (terminal) velocity
   - Sedimentation coefficients (measurement)
   - Viscous forces and Brownian motion

(4) Particle-particle electrostatic forces
   - Sedimentation equilibrium - a case study for aqueous pollutants
   - Particle-particle interactions
   - Inter-molecular forces related to inter-particulate forces
   - Hamaker theory
   - Electrical charges in dispersions
   - Guoy-Chapman and the Debye-Hückel approximation
   - Debye thickness and total surface charge
   - Double layer overlap
   - DVLO recap and the CCC scale

(5) Colloidal stability
   - Stability ratio and overall flocculation rate
   - Steric effects
   - Aerosols - air filtration
   - Surface tension
   - Sesile drop, wetting and spreading, porosimetry
   - Wetting irregular surfaces and the Jamin effect
   - Surface active solutes – miscible, immiscible and partially miscible
   - Emulsion stability – HLB scale, PITs and emulsifiers in froth flotation
   - Foams

TEXTBOOKS:
Although no textbook is required, reading will be assigned using on-line resources available to University of Calgary Students. The following additional texts may be useful to students:

* Colloid Science: Principles, Methods and Applications, 3rd. Terence Cosgrove, Blackwell (2005) [online at the University of Calgary]
* Contact Angle, Wettability and Adhesion, Vol. 4., Kash L. Mittal (2006) [Online at the University of Calgary]