

UNIVERSITY OF CALGARY  
DEPARTMENT OF CHEMISTRY  
**COURSE SYLLABUS**  
WINTER 2019

**COURSE: CHEMISTRY 579, Surface and Colloid Chemistry for Engineers**

LEC	DAYS	TIME	ROOM	INSTRUCTOR	OFFICE	EMAIL	OFFICE HOURS
L01	MWF	10:00-10:50	ES 162	Dr. Robert Marriott	SB 221	Rob.marriott@ucalgaary.ca	MWF 11:00 – 1:00

**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 CO<sub>2</sub> 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
  - Sessile 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 floatation
  - 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:

*Principles of Colloid and Surface Chemistry*, 3<sup>rd</sup>. Ed., Paul C. Hiemenz and Raj Rajogopalan, CRC (1997)  
*Colloid Science: Principles, Methods and Applications*, 3<sup>rd</sup>. 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]  
*Colloidal Dispersions: Suspensions, Emulsions and Foams*, Ian D. Morrison and Sydney Ross, Wiley (2002)

Department Approval: Original signed by Head of Dept. Date: January 7, 2019