UNIVERSITY OF CALGARY
DEPARTMENT OF CHEMISTRY
**COURSE SYLLABUS**
**WINTER 2020**

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

| LEC | DAYS | TIME | ROOM | INSTRUCTOR | OFFICE | EMAIL | OFFICE HOURS |
|---|---|---|---|---|---|---|---|
| L01 | TR | 11:00-12:15 | ENA 103 | Dr. Robert Marriott | SB 221 | Rob.marriott@ucalgaary.ca | TR 12:30 – 2:30 |

**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
- Excercise 3 – drying a high-pressure $CO_2$ 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 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*, 3rd. Ed., Paul C. Hiemenz and Raj Rajogopalan, CRC (1997)
*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]
*Colloidal Dispersions: Suspensions, Emulsions and Foams*, Ian D. Morrison and Sydney Ross, Wiley (2002)

Department Approval_____Electronically Approved_____Date_____January 6, 2020_____