SEMESTER SYLLABUS

CHE 644: Colloidal Hydrodynamics

X Semester 20XX

Semester Session XXXX **XXXX**

Instructor: Christopher Wirth **Room XXXX**

Email: c.wirth@csuohio.edu (FH 438)
Office hours: XXXXX

Catalog Description: **Colloidal Hydrodynamics**
Prerequisite: Graduate standing in Chemical Engineering or Permission of instructor.
Description: Fundamental aspects of colloidal suspensions, Brownian motion, interparticle interactions, particles exposed to flow, suspension rheology, electrophoresis, and electroosmosis, as well as the importance of these phenomena to consumer, industrial, and biomedical applications.

Textbook (PDF distributed on Blackboard):
- Prieve, D.C. "Physical Chemistry of Colloids and Surfaces" © DC Prieve, 2014

Note: In *Prieve*, the lecture #'s do not correspond to lectures in this course.

Reference Material:
- Guazzelli E, Morris, J.F. "A Physical Introduction to Suspension Dynamics", Cambridge University Press (2012)
- Jones, T.B. "Electromechanics of Particles", Cambridge University Press (2005)
- Larson, R.G. "The Structure and Rheology of Complex Fluids" Oxford University Press (1999)
- Selected readings provided by instructor.
- Journal articles associated with final project.

Coordinator: Christopher L. Wirth, Assistant Professor, Department of Chemical and Biomedical Engineering

Goals: The objective of this course is to introduce students to current work in the areas of colloidal hydrodynamics, or more generally the flow of fluid containing particulate materials (i.e. suspensions) in response to external fields. There are a variety of industrial applications of these phenomena, ranging from the chemical industry to microfluidic biomedical diagnostics. For example, a variety of biomolecular separation techniques rely on the response of a charged particle to an electric field (electrokinetics). A broad range of topics will be covered, including colloidal scale forces, suspension stability, Brownian dynamics, hydrodynamic interactions, colloids responding to flow, electroosmosis, DNA electrophoresis, dielectrophoresis, and applications of these phenomena. Students will gain familiarity with current literature via reading and analysis of journal articles targeted in a research area picked by the student; this exercise will culminate in a final project.

Prerequisites by Topic:
- Graduate standing in Chemical Engineering or Permission of instructor.

Topics and **Tentative Outline**

What is Colloidal Hydrodynamics?	Week 1
Brownian motion	Weeks 1 - 2
Particles in fields: Sedimentation	Weeks 2 - 3
Non-hydrodynamic particle pair interactions	Weeks 3 - 5
Optical Microscopy Tools in Colloidal Physics	Week 5
Test 01	**Week 6**
Particles in fields: Electrokinetics	Weeks 7
Conventional and Next Generation Applications of Electrokinetics	Week 8
Particles in fields: Viscous Flow	Weeks 9 – 10
One Sphere in Stokes Flow	Week 10 - 11
Macroscopic Phenomena in Suspensions	Weeks 12 - 13
Written portion of project due & time allotted for project presentations	Week 14 - 15

Most of the course material, assignments, and outside office-hours consultation will be done via the Chemical Engineering Courses Web Site： http://www.csuohio.edu/elearning/blackboard/index.htm Access to the Internet can be procured from College facilities, or via Internet Access sites.

Laboratory Projects: N/A

ABET Category Content: N/A

Prepared by: Christopher Wirth, Assistant Professor, Department of Chemical and Biomedical Engineering

Grading Policy: The final grade will be based on five (5) problem sets (5 x 10%), one (1) paper analysis (10%), one (1) test (15%), and a final individual project (5% draft + 10% final report + 10% oral portion).

Project description, CHE 644

(1) Written review and analysis of current literature in research area picked by student. Research area must be related to the broad areas of Colloidal Physics and cleared by instructor (Topic by XXXX).

(2) Think of and develop a new perspective or idea in the above mentioned research area. For example, a description of a novel experiment and/or sample calculations will satisfy this requirement. **Written project should be 8 – 10 pages, double spaced, including all figures and references.**

(3) Oral presentation to class that clearly describes specific research area and new insight (Week 15). **Oral presentations will be scheduled for no more than 12 minutes each.**

Important Dates

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Grading breakdown

100 - 90	A
89 - 85	A-
84 - 80	B+
79 - 70	B
69 - 65	B-
64 - 55	C
54 - 0	F