

Course Outline Chemical Engineering 790 -RP January. 2008

Title: Selected Topics in Colloid and Surface Science

Instructor: Robert Pelton

Thursday Evening – 5:30 -8:30, JHE 342 pm, winter term

Course Objective

The emphasis of this year's course will be **hydrogels** which is critical in many areas in including material science, polymer processing, biomaterials, and water treatment.

The contents of the lectures are:

Contents

- **Introduction to Hydrogels**
 - Types of gels
 - Structure (crosslinking)
 - Hydrogel/water Interface
 - Hydrogel/air Interface
- **Hydrogel Swelling**
 - Nonionic gels
 - Ionic gels
- **Colloidal Hydrogel Electrophoresis**
 - Review of hard particle electrophoresis
 - Ohshima's theory for gels
 - Some data
- **Mechanical Properties of Hydrogels**
 - Introduction
 - Range of properties
 - Comparison with other materials
 - Rubber elasticity
 - Effect of swelling
- **Hydrogel Rheology**
 - Some Definitions
 - Rheological Measurements
 - Ideal systems
 - Example Polymer to gel Transition
 - Colloidal hydrogels
- **Adhesion to Hydrogels**
 - Forces in hydrogel adhesion
 - Thermodynamics of adhesion
 - Adhesion Phenomenology
 - AFM Based Adhesion Testing
 - Adhesion Testing with Micropipettes
 - Compression Testing
 - Peel Testing
 - Measuring Tack
 - Shear Testing
 - What's special about hydrogel Adhesion
 - Case Study – Adhesion to Cellulose Hydrogel
- **Hydrogel Friction and Lubrication**
 - Amonton's Law
 - Polymer Brushes and Solutions
 - Hydrogel friction
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The course will consist of the following activities:

- a) Lectures from the instructor for ~ 1/2 term.
- b) 1 lectures from each students on an aspect of hydrogels
- c) Each student will submit a 2000 word major assignment. One half of the document will critically review the existing literature and the second half will be a research proposal in this topic. The proposal should: a) clearly state the hypothesis/objectives; b) describe the experimental or theoretical approaches; and, c) describe what you think will be the most challenging aspects of the proposed work. The assignment topic will attempt to link the student's research interests to hydrogels

Assessment: *Lecture 50% and proposal 50%, proposal.. The final percentage grades will be converted to letter grades using the Registrar's recommended procedure. Statistical adjustments (such as bell curving) will not normally be used". The maximum mark for late assignments will be decreased by 50% accumulatively for everyday late including weekends.*

Resources: *there is no required text – copies of the lecture notes will be provided as well as supplementary recourse material.*

Policy Reminders:

Senate and the Faculty of Engineering require all course outlines to include the following reminders:

“The Faculty of Engineering is concerned with ensuring an environment that is free of all adverse discrimination. If there is a problem, that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.”

“Students are reminded that they should read and comply with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty as found in the Senate Policy Statements distributed at registration and available in the Senate Office.”