

King Fahd University of Petroleum and Minerals
Civil Engineering Department
CE 544 – Unit Operations and Processes Lab

Dr. Muhammad Shariq Vohra

Goals: The course is designed to enhance the capabilities of graduate students in applying the theories of water and wastewater treatment to actual systems through designing and testing laboratory models of various treatment units with particular emphasis on impact assessment of various design parameters as well as water quality factors on treatment efficiency. Students will also get familiar with several conventional and state of the art analytical techniques for water testing.

Course Outline:

| <u>Class & Lab Topic</u> | <u>Week(Tentative)</u> |
|---|------------------------|
| Introduction | 1 |
| Coagulation & Flocculation | 2, 3 |
| -Using Metallic Salts | |
| -Aluminum Sulfate | |
| -Determination of Optimum Coagulant Dosage | |
| -Determination of Optimum pH | |
| -Tapered Flocculation | |
| -Ferric Chloride | |
| -Determination of Optimum Coagulant Dosage | |
| -Determination of Optimum pH | |
| -Tapered Flocculation | |
| -Using Polymer | |
| -Determination of Optimum Polymer Dosage | |
| -Tapered Flocculation | |
| Adsorption | 4 |
| -Adsorption Equilibria | |
| -Study of a Continuous Flow Adsorption System | |
| Field Trip for Project | 5 |
| Water Softening | 6 |
| -Chemical Precipitation | |

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| Sedimentation | 7 |
| -Flocculent Settling | |
| -Process Efficiency w.r.t. Overflow Rate & Settling Time | |
| Field Trip | 8 |
| Ion Exchange | 9 |
| -Removal of Toxic Metal Species | |
| -Resin Selectivity Study | |
| Filtration | |
| -Filtration | 10 |
| Heterogeneous Catalysis | 11 |
| -Degradation of Organic Contaminants | |
| Redox Processes | 12 |
| -Oxidation of Ferrous Ion | |
| -Oxidation of Manganous Ion | |
| Disinfection | 13, 14 |
| -Conventional Chlorination Process | |
| -UV-light Induced Disinfection | |
| Presentations | 15 |
| -Course Project Presentations | |

Text Book: Wastewater engineering: Treatment and reuse, Metcalf & Eddy, 4th Edition, 2003, McGraw Hill.

References: Environmental engineering unit operations and unit processes laboratory manual (Association of Environmental Engineering Professors).

Water works engineering: Planning, design and operation. S.R. Qasim, E.M. Motley, and G. Zhu, 1st Edition, 2000, Prentice Hall.

WebCT: I will post the class handouts on the CE 544 WebCT site.

Safety: The given lab Safety Instructions should be observed.

Points-Distribution:

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| Project | 25% |
| HWs | 05% |
| Lab Reports* | 45% |
| Final | 25% |

Total: 100%

* Please follow the given Laboratory Report Format instructions