Course Objectives: At the end of this course you should be able to plan/hypothesize, design, and execute laboratory experiments of medium complexity, collect and analyze data, write technical reports, and make presentations of your research outcome.

At the class time, please come to 3578, Engineering Building (Teaching Lab). Joseph Nguyen will provide the basic laboratory safety training, show you the laboratory, supplies and equipment that are available for use in your experiments, and help you get the keys to the laboratory.

A total of three experiments can be completed over the semester. Your choice of experiments should be distributed so that you gain experience in each category (reactor operation, physico-chemical processes, and biological processes). Some of the Experiments may require LabView. A short LabView introduction from one of your colleagues is available on the course website. Set up for the following experiments is available. Please visit the course website, right click and save to download the relevant report(s) from previous year(s), and read it thoroughly.

A. Reactor Operation: Example projects are:
   - Plug Flow Reactor
   - CSTRs in Series
   - Oxygen Uptake Rate
   - Sand Filter Backwashing

B. Physicochemical Processes: Example projects are:
   - Water Softening and Color Removal by Coagulation/Flocculation
   - Biosensors using Quartz Crystal Microbalance
   - Phosphorus Removal using Fluidized Bed Reactor
   - Membrane Filtration
   - Catalytic Conversion of Chlorinated Solvents

C. Biological Processes: Example projects are:
   - Biofilms Development Kinetics
   - Bacterial Removal Efficiency in Home Water Filtration Units
   - Antibiotic resistance determination by culturing
   - Quartz Crystal Microbalance for DNA Sensor Development
   - Temperature Effects on OUR in Activated Sludge
   - Toxicity of Single Wall Nanotubes to Escherichia coli
   - Anaerobic Digestion

D. Tentative Activity/Topic Schedule

<table>
<thead>
<tr>
<th>Class</th>
<th>Topics/Activity</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Introduction to the Course, Lab Safety Training, and Scheduling of Experiments: Expectations related to work ethics, lab attendance, discussions, journal articles, and exams</td>
<td>1/10</td>
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<tr>
<td>Date</td>
<td>Task</td>
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<tr>
<td>1/12</td>
<td>Choice of first experiment by each group and identifying resources</td>
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<tr>
<td>1/17</td>
<td>Martin Luther King Day: No class</td>
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<tr>
<td>1/19, 24, 26, 31, 2, 7, 9, 14, 16</td>
<td>Work on the experiment of your choice (Interim discussions for planning and data sharing are part of each day’s activity).</td>
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<tr>
<td>2/21</td>
<td>Examination I: Submit a brief journal article (Applied and Environmental Microbiology format) on your first completed experiment</td>
<td></td>
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<tr>
<td>2/23, 28, 2</td>
<td>Work on the experiment of your choice</td>
<td></td>
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<tr>
<td>3/6, 10</td>
<td>Spring Break</td>
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<tr>
<td>3/14, 16, 21, 23, 28, 30</td>
<td>Work on the experiment of your choice</td>
<td></td>
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<tr>
<td>4/4</td>
<td>Examination II: Submit a journal article written in &quot;Environmental Science and Technology&quot; style article on your second completed experiment.</td>
<td></td>
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<tr>
<td>4/6, 11, 13, 18, 20, 25, 27</td>
<td>Work on the experiment of your choice</td>
<td></td>
</tr>
<tr>
<td>11/11</td>
<td>Final Examination: Written exam on all completed experiments</td>
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**3 PM to 5 PM.**

**TEXTBOOK**

There is no single textbook that is suitable for this course. Reports and references to suitable material will be provided as needed throughout the course. Some of the processes (especially the physicochemical processes) are described in Wastewater Engineering Treatment and Reuse Metcalf & Eddy, Inc. George Tchobanoglous Franklin Burton H. David Stensel (Metcalf and Eddy 4th Edition). Conducting professional quality literature search is a part of the course. If you are unfamiliar with the numerous tools that are available to conduct literature search, please consult me.

**GRADING POLICY**

Grades will be based upon the total points accumulated for three examinations and research, and lab skills and the ability to work in a team. Distribution of scores is as follows:

- **Exam I**: 25% (Research article for a peer-reviewed journal)
- **Exam II**: 25% (Research article for a peer-reviewed journal)
- **Final Exam**: 30% (written exam on content and principles)
- **Research Skills**: 10% (Student initiated discussions of the experiments (engaged discussions about experimental design, execution, results, & report, lab records)
- **Lab and Team Skills**: 10% (Lab etiquette, attendance, and Team skills)
- **Total**: 100%
EXAM POLICY

There will be two mid-semesters and one final examination. For Examination I, you will be required to submit a journal manuscript on your first completed experiment. For Examination II, you are expected to submit a journal manuscript on your second completed experiment. Exams I and II will be scored for the team.

Final Examination will contain a written test of your knowledge about the work you have conducted during the whole semester. Final exam, individual initiatives and discussions, and teamwork will be scored individually!

Research Skills Evaluation: Since ENE806 is a research-oriented course, 20% of your grades are based on research oriented skills that are generally needed in the lab. These include: i) Student-initiated discussions of experimental design, planning, execution, and report preparation, and ii) Lab etiquette, attendance, and teamwork. The importance of this aspect for this course and to learn and demonstrate research related skills cannot be overemphasized.

HOMEWORK POLICY

There is no homework for this course. But you are expected to spend about 5-8 hours per week in literature review, experimental planning and data analysis that is in addition to the time spent in the lab in conducting the experiments.

INSTRUCTOR

Syed A. Hashsham, Professor
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Phone 355-8241 Fax 355-0250; Email: hashsham@egr.msu.edu
Office hours: To be decided