Engineering 4V04: Physico-Chemical Processes in Water and Wastewater Treatment

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Course Objectives: Upon the completion of this course, students will have a solid understanding of the fundamentals in physico-chemical treatment processes for water and wastewater treatment. They will be able to use relevant skills and techniques in designing and evaluating individual treatment processes.

Course Topics:
Water Quality
- Terminology use in water and wastewater, measurements (standard methods, field methods, estimations)
- Standards and regulations for drinking water quality and wastewater discharge

Flocculation and Coagulation
- Particle interactions, chemical reactions and pH dependency

Sedimentation
- Settling mechanics in water and wastewater treatment, clarifier design

Filtration (media filtration)
- Particle interactions, slow-sand filters, rapid filters, filtration system design

Membrane filtration
- Membrane pore sizes and processes, fouling and cleaning
- Membrane bioreactors

Gas transfer
- Gas transfer rate and bubble size
- Aeration requirements and sizing aeration systems

Disinfection
- Disinfection technologies, advantages/disadvantages (chlorine/chloramine, ozone, UV)
- Disinfection byproducts, chlorine residual and distribution, contact time and dose

Additional Treatment
- Activated carbon adsorption, hard water and water softening, seawater desalination


Evaluation:
- Assignments 20%
- Term Project 5%
- Laboratory Attendance and Reports 15%
- Midterm Exam 25%
- Final Exam 35%

MSAF policy: MSAF will not be accepted for missed exams or term projects. Missed work will not have the weight transferred to other work.

Assignments: All assignments will be posted on Avenue to Learn. Late assignment will be penalized 10% per academic day.

Term Project: Term project topic will be posted after the midterm examination. Term projects will be completed as a group project with your laboratory group. Group members are equally responsible and there is no job captain for the term project, and all members will receive the same grade.
Examinations: The McMaster Standard Calculator may be used during examinations. A hand-written crib sheet may be brought into examinations. No photocopied, printed, or otherwise digitally reproduced materials are permitted on the crib sheet. One double-sided sheet is allowed for the midterm and up to two sheets are allowed for the final examination.

Tutorials: Tutorials will be used for the preview and review of exams and homework assignments, as well as review sessions for prerequisite materials. Tutorial will not be held weekly, and will be announced in class and on Avenue to Learn.

Laboratory Experiments: Laboratory participation is mandatory. The laboratory sessions will involve practical exposure to concepts covered in lectured. There will be four lab sessions in addition to a mandatory preliminary lab to cover lab safety and expectations. Laboratory sessions will generally be held biweekly, and dates will be posted on Avenue to Learn. Laboratory experiments will be performed in groups of 4. Each member is expected to contribute in every lab, and each member will act as job captain for one lab. The lab report will be weighted more heavily on the job captain for each report. A formal write-up is expected for each lab report, and detailed expectations will be outlined during the preliminary lab and posted in Avenue to Learn under the lab section. Lab reports are due the next lab session. A late penalty of 20% per academic day will be applied.

Laboratory Safety: The Faculty of Engineering is committed to McMaster's University Workplace and Environmental Health and Safety Policy which states: "Students are required by University policy to comply with all University health, safety and environmental programs". It is your responsibility to understand McMaster University Workplace and Environmental Health and Safety programs and policies.

For information on these programs and policies please refer to McMaster University Environmental and Health Support Services Occupational Safety Risk Management Manual at (suggested reading: Sections 10 through 16): http://www.workingatmcmaster.ca/link.php?link=eohss:lab%20safety%20handbook

It is also your responsibility to follow any specific Standard Operating Procedures (SOPs) provided for some of the experiments and the laboratory equipment. The safety requirements for JHE 220 are listed below. Students not abiding by these safety requirements will be given one warning. Second offences will result in the student being asked to vacate the laboratory, and receiving a grade of zero for that particular lab.

- Glasses or safety glasses/goggles must be worn in the lab at all times
- Contact lenses are not to be worn in the lab.
- No short (i.e., above the knee) pants or skirts are permitted in the lab – lab coats must be worn over top of your clothing in these instances.
- Closed-toe shoes must be worn at all times.
- No loose clothing allowed.
- Long hair must be tied back.
- Gloves must be worn when working with hazardous chemicals (as indicated by the laboratory instructor).

Academic Integrity: It is your responsibility to understand what is academic dishonesty. For information on McMaster’s policy on academic dishonesty, what constitutes as academic dishonesty, and the consequences, please refer to http://www.mcmaster.ca/policy/Students-AcademicStudies/AcademicIntegrity.pdf