School of Environmental Systems Engineering  
Faculty of Engineering, Computing and Mathematics  
The University of Western Australia  

Water and Wastewater Treatment  

ENVE4609  

Unit Outline and Assessment Information 2011  

Unit coordinator: Anas Ghadouani  
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Phone: 6488-2687  

Lectures:  
Monday 10-10.45 – Engineering - Civil & Mechanical: Lecture Room 261  
Wednesday 11-12.30 – Engineering - Civil & Mechanical: Lecture Room 245  

Lecturers:  
Anas Ghadouani  
Guest speakers  

Tutor:  
Liah Coggins  
coggil01@student.uwa.edu.au  

Unit website:  
http://www2.sese.uwa.edu.au/online_units/  

Outcomes  
The unit is intended to develop your ability to:  
• Apply knowledge of engineering fundamentals  
• Communicate effectively  
• Undertake problem identification  
• Utilize a systems approach to design  
• Function effectively as an individual  
• Function effectively as a multi-disciplinary team  
• Understand the principles of sustainable design  

Content  
This unit will present a current and modern overview of Water and Wastewater Engineering with a focus on the treatment and reuse in a broad environmental context. The fields of water and wastewater engineering have evolved more recently into a modern field of engineering following important advances in the technologies used in primary disciplines such as environmental chemistry and microbiology. In particular major advances/changes have occurred with respect:
• The characterization of constituents found in waste water, both in terms of range and detection limits;
• A greater fundamental understanding of the mechanisms of biological wastewater treatment;
• The application of advanced treatment methods for the removal of specific constituents;
• The increased emphasis on the management of biosolids resulting from the treatment of wastewater; and
• The issuance of more comprehensive and restrictive permit requirements for the discharge and reuse of treated wastewater.

Given the diversity and wide range of topics relevant to the unit, priority will be given to these emerging issue and the unit will aim at presenting a comprehensive and yet deep understanding of the field of water and wastewater engineering. However, a wide range of material will be available to the student to explore in addition to the topic presented in class.

Recommended Text:


Topics:

1. Wastewater Engineering: An overview
   Terminology and historical overview
   Impact of regulations on Wastewater engineering
   Health and Environmental Concerns in wastewater management;
   Wastewater treatment
   Wastewater Reclamation and Reuse;
   Biosolids and Residuals Management

2. Constituents or composition of Wastewater:
   Wastewater constituents;
   Constituents of concern;
   Sampling and Analytical Procedures
   Physical Characteristics
   Organics
   Metallic constituents
   Aggregate Organic constituents

3. Introduction to Process Analysis and Selection:
   Reactors used for the treatment
   Mass-Balance Analysis
   Modelling ideal Flow in Reactors

4. Fundamentals of Biological Treatment:
   Role of microorganisms in Wastewater treatment
   Types of Biological Processes
   Composition of microorganisms
   Microbial Metabolism
   Bacterial Growth and Energetics
5. **Suspended Growth Biological Treatment Processes:**
   - Activated Sludge Process
   - Fundamentals of Process Analysis and Control
   - Processes for BOD removal
   - Processes for Nutrient Removal

6. **Advanced Wastewater Treatment:**
   - Technologies used in advanced Treatments;
   - Advanced Oxidation Processes
   - Membrane Filtration Processes
   - Adsorption

7. **The design and Construction Processes:**
   - Conceptual design;
   - Establishment of Design Criteria

8. **Treatment-Plant Performance:**
   - Need for upgrading
   - Treatment Process Reliability and Performance assessment;

9. **Water Reuse:**
   - Principles and historical perspective;
   - Need for Water Reuse
   - Public Health and Environmental Considerations
   - Risk assessment
   - Water Reclamation Technologies
   - Storage of Reclaimed water
   - Industrial Water Reuse
   - Groundwater Recharge

10. **Management and Disposal of Biosolids:**
    - Solid sources, characteristics and quantities;
    - Regulations for the reuse and disposal of biosolids;
    - Thickening and Digestion Processes;
    - Dewatering, Heat drying and Incineration;

11. **Constructed Wetlands for Wastewater Treatment:**
    - Wetland values and function;
    - Natural and constructed Wetlands of wastewater treatment;
    - Surface Flow Systems;
    - Sub-surface Flow Systems with Vertical and Horizontal Flow;
    - Hybrid Systems;
    - Zero Discharge Systems.

12. **Discharge of Wastewater: Policy, Framework and Regulations**

**Assessment**

Students will be assessed on the following three components:

1. Individual assignments 3@10% 30%
2. Individual Design Project 30%
3. Final take-home Exam 30%
4. Participation in lectures and collaborative learning 10%
Assignment and project due dates
1. Individual assignments:  
   Assignment 1 (10%), due date: 15/08/2011  
   Assignment 2 (10%), due date: 29/08/2011  
   Assignment 3 (10%), due date: 12/09/2011  
2. Individual Design Project: (30%), due date: 31/10/2011  
3. Final Take Home Exam: (30%), open from 31/10 to 7/11/2011/

Tutorials
Tutorial time will be used for site visits and other activities.

Marks for this unit will be displayed at:

https://secure.csse.uwa.edu.au/run/csmarks

Plagiarism
You must be aware of the definition of plagiarism, see:
http://www.ecm.uwa.edu.au/for/students/plagiarism

Instances of Plagiarism will be dealt with in accordance to the UWA Policy for Academic Conduct.

You will be reported to the Associate Dean (Students) and a record will be kept of the case and penalty given, for future reference.

Charter of student rights
This Charter of Student Rights upholds the fundamental rights of students who undertake their education at the University of Western Australia.

It recognises that excellence in teaching and learning requires students to be active participants in their educational experience. It upholds the ethos that in addition to the University's role of awarding formal academic qualifications to students, the University must strive to instil in all students independent scholarly learning, critical judgement, academic integrity and ethical sensitivity.

For the full charter of student rights, please refer to:
http://www.secretariat.uwa.edu.au/home/policies/charter

Appeals against academic assessment
If you feel you have been unfairly assessed, you have the right to appeal your mark by submitting an Appeal Against Academic Assessment form to the Head of School and Faculty Office. The procedure for Appeals, and the required forms, can be found at:
http://www.ecm.uwa.edu.au/for/students/exams
The form must be submitted within **twelve working days** of the formal release of your unit assessment. It is recommended that you contact the Guild Education Officers for aid in the appeals process. They can be contacted on +61 8 6488 2295 or education@guild.uwa.edu.au.

**Notes:**