Waste Water Collection and Treatment

MODULE TITLE	Wastewater collection and treatment
LECTURER(S)	Dr A. Katsiri and Dr B. Kompare
ECTS VALUE	8
PREREQUISITES	Hydraulics, Chemistry, Microbiology
COREQUISITES	Storm water
DURATION OF MODULE	15 weeks

TOTAL STUDENT STUDY TIME

Overall, the module is expected to involve students in approximately 200 hours of learning: 12 5-hour lectures; 58 hours assignments; 78 hours private study; 4-hour examination.

WEB LINK http://www.water-msc.org/en/wrem202.htm

AIMS

This module aims to provide a basic knowledge of classical and contemporary problems in the management of wastewater for the practising engineer. It provides a basic knowledge of the main physical, chemical and biological processes used for the treatment of wastewater. It offers gaining practical experience in selecting the appropriate wastewater collection and treatment schemes, and in designing the required works.

INTENDED LEARNING OUTCOMES

1. Subject Specific Knowledge, Understanding and Skills

By the end of this module, the students should:

a) have acquired an understanding of waste water collection system components, their characteristics and functioning of such systems;
b) be able to design a wastewater collection system;
c) be able to estimate or measure the pollution load of wastewater produced in an area or from a particular activity;
d) have acquired a basic understanding of unit treatment processes;
e) understand the role, the kinetics and the factors affecting the performance of microorganisms in a particular biological treatment process;
f) be able to design treatment units;
g) recognize the environmental impact of wastewater discharge to the environment.

2. Core Academic Skills

By the end of this module, the students should:

a) be able to identify, formulate and analyse a management problem in a given water collection/treatment system, i.e. assess the situation, formulate alternatives and recommend feasible solutions;
b) be able to critically assess research results;
c) have acquired some practical experience of using wastewater collection and treatment modelling tools;

d) have acquired an understanding of the impact of solutions for civil engineering works.

3. Personal and Key Skills

By the end of this module, the students should have:

a) improved further the necessary skills for independent learning;

b) enhanced report and presentation skills;

c) acquired an ability to function in multi-national teams.

LEARNING/TEACHING METHODS

Lectures, self assignment exercises, problem solving, tutorials.

ASSIGNMENTS

Several assessed coursework assignments (6,000 equivalent words in total including graphs and tables).
Problem sheets and tutorials.

ASSESSMENT

Examination paper (60%), Course work (40%)
3-hour examination, open notes and open books.
Several small assignments and exercises on practical application of wastewater treatment facilities design and modelling tools.

SYLLABUS PLAN

1. **Introduction:** Constituents in wastewater, sampling and analytical procedures, Physical, chemical, biological characteristics, toxicity.
2. **Mixed and separate sewerage systems**: Gravity, pressurized and vacuum systems. Design and operational approaches. Structural element.
3. **Mathematical modelling of mixed sewerage systems**: Gravity systems, the SWMM model.
4. **Introduction to process analysis and selection:** Mass balance, modelling flow in reactors, reaction kinetics.
5. **Modelling Treatment Process Kinetics**: mass transfer and process selection
6. **Chemical unit operations processes:** pH neutralization, alkalinity correction, coagulation and precipitation.
7. **Physical unit operations processes:** Screening and grit removal, mixing, gravity separation (discrete vs. flocs.
8. **Fundamentals of biological treatment:** Microbial growth kinetics, modelling suspended and attached growth treatment processes, biological nitrification and denitrification, biological phosphorous removal
9. **The activated sludge model**
10. **Stormwater treatment and disposal**: highways, parking lots, paved areas. Alternatives for onsite storage, treatment, and infiltration.
11. **Treatment reuse and disposal of solids and biosolids**.
12. **Fundamental economics in design and operation of WW systems and WWTPs**.

INDICATIVE BASIC READING LIST

1. Tchobanoglous G, Burton F.L., Stensel H. D., *Wastewater Engineering – Treatment and Reuse*, Metcalf and Eddy Inc., McGraw-Hill, 4rth Edition, 2003. (ISBN 0-07-11250-8)
2. Shun Dar Lin., *Water and Wastewater Calculations Manual*, McGraw-Hill, 2001.

(ISBN 0-07-1371958)
3. Henze M., Harremoes P., la Cour Jansen J., and Arvin E., *Wastewater Treatment: Biological and Chemical Processes*, Springer, 3rd Ed., 2001. (ISBN 3540422285)
4. R.L. Droste (1997) *Theory and Practice of Water and Wastewater Treatment,* John Wiley & Sons Inc., USA.
5. ASCE, Gravity Sanitary Sewer Design and Construction, ASCE Manuals and Reports on Engineering Practice No.; 60, 1982. (ISBN 0872623130)

EXTENDED READING LIST

Kiely G., Environmental Engineering, McGraw-Hill, 1996 (ISBN 0-07-709127-2)

AUTHORS

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