Addis Ababa Institute of Technology

Civil Engineering Department

Course Outline

Module Title: POLLUTANT FATE AND TRANSPORT, **Course code:** CENG 6405, **CH:** 3

Evaluation Schemes: Continuous Assessment: **50%**; Final Exam: **50%**

Course Description

This course introduces the concept of transport processes in the environment with emphasis on Movement and transformation of pollutants/contaminants released in the water environment. Fundamentals of diffusion, advection, dispersion, reaction and sorption. Aggregation and parameterization of various mixing processes, leading to dispersion at spatial and temporal scales. Importance of heterogeneity, anisotropy and stratification in natural media. Basic principles are illustrated by application to river, lakes, and groundwater pollution problems.

Course Outline

1. **Introduction to Pollutant Fate and Transport (4 weeks)**
   - 1.1 Sources and types of pollutant
   - 1.2 An overview of pollutant fate and transport modeling
     - 1.2.1 The mass balance and representative elementary volume
     - 1.2.2 Pollutant transport mechanisms
     - 1.2.3 Physical, Chemical, and Biological Transformations
     - 1.2.4 Chemical distribution among phases
2. **Fate and Transport in surface water (4 weeks)**
   - 2.1. Fate and Transport in river system
     - 2.1.1. Water velocity and stream flow regimes
     - 2.1.2. Settling and transport with sediments
     - 2.1.3. Mass-balance equations
     - 2.1.4. Non-conservative pollutants
     - 2.1.5. Self-purification and the oxygen balance
   - 2.2. Fate and Transport in lakes and reservoirs
3. **Fate and Transport in Subsurface Water (4 weeks)**
   - 3.1. Basics of groundwater flow
   - 3.2. Physical transport mechanisms in groundwater
   - 3.3. Dispersion and retardation in groundwater
   - 3.4. Movement of DNAPL's and LNAPL's

Course Textbook

Chemical Fate and Transport in the Environment by Hemond and Fechner is used as a text for the subject. The text provides a basic source to initiate topics, and it is supplemented by lecture notes during the course.

Reference

1. Elsevier, Principles of contaminant Transport in soil (Library, 5 Killo)
2. J. Wiley, 2005, Integrated Environmental Modelling, Hoboken, NJ, (Library, 4 Killo)
3. Wilbert Lick, 2009, Sediment and contaminant transport in surface waters (Library, 5 Killo)
4. Zheng Chunmiao, Applied Contaminant Transport modelling, New York, (Library 4 Killo)