Fall 2015

# Environmental Systems Analysis - Hong Kong University of Science and Technology, Hong Kong

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| Rubric | CIVL 4440 |
| Title of course | Environmental Systems Analysis |
| Instructor | NG Tze Ling<br>Dept. of Civil and Environmental Engineering<br>Room: 3565; email: tzeling@ust.hk; phone: 2358-5974 |
| Teaching assistants | Pan YANG (pyangac@ust.hk) |
| Lecture | Mon 4:30-5:50 PM, Fri 12:00-1:20 PM, Room 3598 (Lift 27-28) |
| Prerequisites | CIVL 2410 or ENVR 2010 |
| Credits | 3 |
| Course description | This course introduces principles of systems analysis for the planning and management of the environment. The course aims to provide students with the ability to define environmental systems, evaluate alternatives for making optimal decisions, and develop sustainable solutions. Simple to complex case studies are used to present concepts of environmental modeling and single-objective optimization to identify best strategies for environmental quality control. Concepts of multi-objective optimization and Pareto efficiency are also presented for solving problems with conflicting economic and environmental goals. These key concepts are applied to a selection of problems, including problems of water and air quality, solid waste management, and climate change. |
| Textbook | --- |
| References | 1. Haith, D. A. (1982). Environmental Systems Optimization. John Wiley & Sons, NY.<br><br>2. Revelle, C. S.; Whitlatch, E. E. and Wright, J. R. (2004). Civil and Environmental Systems Engineering, 2$^{nd}$ edition. Pearson Prentice Hall, NJ.<br><br>3. Willis, R. and Finney, B. A. (2004). Environmental systems engineering and economics. Kluwer Academic Publishers, Boston, MA. |
| Intended learning outcomes | 1. For students to gain an understanding of environmental planning and management problems.<br><br>2. For students to be proficient in defining environmental systems and their boundaries.<br><br>3. For students to grasp basic principles of modeling, optimization and economic analysis in the context of environmental decision-making.<br><br>4. For students to understand ways of evaluating best methods of managing environmental resources.<br><br>5. For students to be aware of current environmental policy issues and their implications. |
| Topics | Introduction to systems analysis<br>Basic principles of environmental modeling<br>Fundamentals of optimization<br>Method of Lagrange multipliers<br>Linear programming<br>Air pollution management using linear programming<br>Piecewise linearization<br>Multiobjective programming<br>Cost-benefit analysis<br>Environmental economics<br>Water quality policy modeling and analysis<br>Mixed integer programming and facility location models<br>Municipal solid waste management using mixed integer programming |
| Computer usage | Students are required to develop spreadsheet models using MS Excel |

| Lab projects | --- |
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| Class/lab schedule | 3 hours lecture per week |
| Contribution to the professional component | 80% engineering topics, 20% environmental economics |
| Assessment of outcomes | There are homework, examinations, and quizzes to test the students' understanding of the subject matter. Credit is also given for class participation. [ILOs 1–4.] |
| Prepared by | NG Tze Ling |
| Date | 22 August 2015 |