Spring 2014

Infrastructure Modeling - George Mason University

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CEIE 601 -- Infrastructure Modeling

Syllabus

Class Time
Thursday, 7:20 – 10:00 pm

Venue
Robinson Hall, room A105  Krug Hall (KH), room 5

Text
This text is recommended but not required: Design and Operation of Civil and Environmental Engineering Systems by ReVelle and McGarity, John Wiley and Sons, 1997.

Course Objectives
To introduce the range of problems encountered in civil, environmental and infrastructure systems engineering.
To introduce the concepts of systems analysis and systems engineering.
To develop the ability to construct appropriate models of complex systems, including multiple objectives.
To use these models to analyze and solve real problems in the field of infrastructure systems engineering.

Homework
Homework assignments are generally available on the web by Friday morning following class, and are due the following Thursday in class.

Software
Word processor, spreadsheet, and optimization software will be useful in this class. Word processor and spreadsheet software is available in all university labs. Optimization software is available in three forms:

1. All modern spreadsheets come with linear and nonlinear optimization solvers. Under "help" in your spreadsheet, search for "optimization" or "solver".
2. Free downloadable versions of LINDO, LINGO, and GINO are available from Lindo Systems (http://www.lindo.com/).
3. The latest versions of various large scale optimization software packages are available in one or more IT&E labs (e.g. GAMS, www.gams.com; CPLEX, www.cplex.com; AMPL, www.ampl.com).

For now you only need the optimization software. No endorsement of these products is implied by their listing here.

Exams
All work on the exams will be done by you individually. No joint work or assistance will be allowed. All questions are to be directed to the instructor.

The midterm exam will be a take-home exam.

The final exam will be a project.

Grades
Homework  30%
Midterm  30%
Final  40%

Email
All email from the instructor will be sent to addresses in the GMU domain exclusively; only email sent from the GMU domain to the instructor will be answered. It is students' responsibility to monitor email to Mason email accounts.
Academic Integrity

The George Mason University Honor Code is in effect for this course. Please consult the University catalog for a complete statement of the Honor Code (http://oai.gmu.edu/honor-code/masons-honor-code/) and see the instructor if you need further clarification.

Writing

The Writing Center at George Mason University can be an invaluable resource to students. The Center offers many services to help you improve your writing. Please use them to ensure that your submissions--homework and papers--are well written. Good writing is expected for all assignments; grades will be reduced for poor writing.

Course Outline

Overview of civil, environmental and infrastructure systems engineering

- definitions, examples from a broad range of application areas, goals of the class

Systems engineering, systems analysis

- definitions, paradigms, concepts

Modeling

- types, objectives, constraints, usefulness, appropriateness, completeness, extra-model aspects of the problem

Decision support tools

- optimization, simulation, probability and statistics, fuzzy modeling, evolutionary computation, ...

Application of modeling to analyze and solve civil, environmental & infrastructure engineering problems

- applications are selected to represent a broad range of problems from urban systems engineering

Computers in the Classroom

If you wish to use a laptop during class, please sit in the back row of the classroom. You are welcome to use a computer to take notes. However, your computer screen is often a distraction for students seated behind you. Sitting in the back row will reduce this distraction.

Accommodations for Disabilities

If you have a learning or physical difference that may affect your academic work, you will need to furnish appropriate documentation to the Office for Disability Services (http://ods.gmu.edu/). If you qualify for accommodation, the ODS staff will give you a form detailing appropriate accommodations for your instructor.

Schedule (Tentative)

This is a tentative schedule of classes, which will likely change based on the decisions regarding the final exam/project, and the interests of the students in the class:

<table>
<thead>
<tr>
<th>Class Meeting</th>
<th>Date</th>
<th>Topic</th>
<th>Reading</th>
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<tr>
<td>2</td>
<td>Jan 30</td>
<td>Political districting</td>
<td>Chapter 5</td>
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<td>3</td>
<td>Feb 6</td>
<td>Water resources</td>
<td>Chapters 1, 13</td>
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<td>4</td>
<td>Feb 20</td>
<td>Vertical alignment of a road; curve fitting</td>
<td>Chapters 7 - 9</td>
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<td>Feb 27</td>
<td>Water quality</td>
<td>Chapter 2</td>
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<td>6</td>
<td>Mar 6</td>
<td>Solid waste management</td>
<td>Chapters 5, 6</td>
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<td>Mar 27</td>
<td>Spring Break</td>
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<td>Mar 13</td>
<td>Spring Break</td>
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<td>7</td>
<td>Mar 20</td>
<td>Air quality Midterm Exam distributed</td>
<td>Chapter 4</td>
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<td>8</td>
<td>Mar 27</td>
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<td>Chapters 6-9, 14 handout</td>
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<td>9</td>
<td>Apr 3</td>
<td>9 Mar 27</td>
<td>Land use, zoning</td>
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<td>10</td>
<td>Apr 10</td>
<td>Location</td>
<td>Chapters 6-9, 14 handout</td>
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<td>11</td>
<td>Apr 17</td>
<td>Scheduling, capacity expansion</td>
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<td>12</td>
<td>Apr 24</td>
<td>Multiple objectives</td>
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<td>13</td>
<td>May 1</td>
<td>Student Presentations</td>
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<td>14</td>
<td>May 6</td>
<td>1 Tuesday</td>
<td>Student Presentation</td>
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<tr>
<td>Exam</td>
<td>May 8</td>
<td>6:45 – 8:45 pm</td>
<td>Student Presentations</td>
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</table>

**Instructor**

Professor Mark H. Houck, PhD, PE

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- **telephone:** 703.993.1737
- **email:** mhouck@gmu.edu
- **Web:** http://mason.gmu.edu/~mhouck/
- **office hours:** Tuesday, 1 – 4 pm, or by appointment