

GARRICK E. LOUIS
Associate Professor of Systems Engineering
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**SCHOOL OF
ENGINEERING
& APPLIED SCIENCE**



*DEPARTMENT OF SYSTEMS and
INFORMATION ENGINEERING*

*University of Virginia
151 Engineers' Way, Box 400747
Charlottesville, VA 22904-4747*

**SYS 601: Introduction to Systems Engineering
Fall 2007**

	Instructor	TA
Office	G. E. Louis	Zhenyu Guo
Phone	434/982-2742	
Email	Gel7f@virginia.edu	Zg9a@virginia.edu
Office Hours	MW 1400-1550	

Class Time/Location: Monday and Wednesday, 12:30-13:45/ OLS 002

Course Prerequisites: Graduate Standing or Permission of Instructor

Catalog Description: An integrated introduction to systems methodology, design, and management. An overview of systems engineering as a professional and intellectual discipline, and its relation to other disciplines such as operations research, management science, and economics. An introduction to selected techniques in systems and decision sciences, including concept mapping, requirements analysis and decision analysis. Elements of systems management, including decision styles, human information processing, organizational decision processes, and information system design for planning and decision support. Emphasis is placed on relating theory to practice via written analyses and oral presentations of individual and group case studies.

Course Philosophy: The primary goal of this course is to challenge the way in which the student thinks; the way in which students approach problem solving. Secondary goals are to familiarize the student with systems engineering methodologies (the "systems approach"), systems engineering science tools (e.g., graphical tools), systems management concepts (e.g., TQM, team building), and systems modeling.

Students are encouraged to participate throughout the semester. This includes classroom interactions and outside the classroom activities, such as group meetings. The nature of this material is not the kind that can be "spoon-fed" to students - the material requires active learning by the student. Reading assignments cannot be briefly scanned -- the student must read the material and reflect on the nature of what the author is trying to communicate.

If any student has any problems with the material, the instructor, the Teaching Assistant, homework assignments, etc., I encourage them to see me or Email as soon as possible. Don't wait for a small problem to escalate into a serious problem. I strongly encourage feedback from the students

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throughout the semester. You can leave a note in my mailbox (signed or unsigned), stop-by my office, or telephone.

The class will cover a new case study each week. On Wednesdays the new case will be presented and discussed in the context of relevant readings from the textbook and supplementary sources. Students will prepare a 10-slide (PowerPoint) presentation on the case to be delivered in class the following Monday. These presentations will be critiqued by members of the class during the question and answer period. There will be 12 of these in-class cases assigned.

There will also be a semester-long project on a Systems Engineering problem of the student's choosing. These will be developed over the semester and presented in an oral presentation and 10-page written report during the last two class periods for the semester.

Texts:

Required:

- *How To Do Systems Analysis*, J.E. Gibson, W.T. Scherer, W.F. Gibson. Wiley, New York, NY. 2007.
- Available UVa Bookstore

Recommended Supplementary Reading

- *The Engineering Design of Systems*, D. Buede, Wiley. NY, NY. 2000.
- *Innumeracy*, J. Paulos, Hill & Wang, New York, NY. 1988.
- *Crystal Ball Software* - Available UVa Bookstore

Additionally:

- Case studies and other supplementary readings will be assigned.

Computer Requirements:

Every student will be required to use Excel, and prepare Powerpoint presentations.

Grading*:

12 Weekly case study presentations @7% each	84%
10-page semester project report	8%
15-slide semester project presentation	8%
TOTAL	100%

* Participation in discussions is an integral part of the grade.

Course Goals: The goals of SYS 601 are:

1. To present the basic principles of systems engineering.
2. To present:



- the history of SE,
 - the methodologies of SE,
 - the tools and techniques SE, and
 - the modeling of systems for SE.
3. To present the applications and practice of Systems Engineering across a broad spectrum of disciplines
 4. To give class members the understanding of the methodology and the applications of SE as a foundation for the practice of Systems Engineering.

Supplementary Readings

- Au, T., and T.P. Au, *Engineering Economics for Capital Investment Analysis*, 2ed. Prentice Hall, Englewood Cliffs, NJ. 1992.
- Buede, D.M., *The Engineering Design of Systems: Models and Methods*, Wiley, New York, NY. 1999.
- Clemen, R.T., *Making Hard Decisions: An Introduction to Decision Analysis*, 2ed., Duxbury Press, Albany, NY. 1995
- Stokey, E., R. Zeckhauser, *A Primer for Policy Analysis*, W.W. Norton & Co. New York, NY. 1978.



Schedule

#	Date	Topic
1	08/29	Syllabus, Introductions, Assign Case 1
2	09/03	Course overview. Toolkit features
3	09/05	Case 1. Passport backlog – Who is the client?
4	09/10	The Systems Approach: Gibson Chs 2, 3. Buede Ch 6. Review Case 1
5	09/12	Case 2. Corn-based ethanol – What is the problem
6	09/17	Objective Trees. Indices of Performance: Gibson Chs 3,4.
7	09/19	Case 3
8	09/24	Evaluation and Ranking - Quantitative criteria
9	09/26	Case 4
10	10/01	Evaluation and Ranking - Qualitative criteria
11	10/03	Case 5
12	10/10	Iteration and Sensitivity Analysis: Gibson Ch 7. Clemen Ch 5
13	10/15	Case 6
14	10/17	Implementation: Action plan. Requirements. Buede Ch 6
15	10/22	Case 7
16	10/24	Review of NPV, Incremental Cost Benefit Ratio: Au & Au Ch 7. Stokey & Zeckhauser Ch 9
17	10/29	Case 8
18	10/31	Review of Linear Programming: Stokey & Zeckhauser Ch 11
19	11/05	Case 9
20	11/07	The 10 Golden Rules of Systems Analysis: Gibson Ch 10
21	11/12	Case 10
22	11/14	Decision Analysis: Clemen Ch 7. 219-232. Buede Ch 13, Stokey & Zeckhauser Ch 12
23	11/19	Case 11
24	11/21	A review of Models: Stokey & Zeckhauser Ch 2
25	11/26	Case 12
26	11/28	Choice and Decision Making: Ztokey & Zeckhauser Ch 3
27	12/03	Term Projects - Teams 1, 2, 3
28	12/05	Term Projects - Teams 4, 5, 6



Recommended Readings from W.T. Scherer, former course instructor

Hall, Arthur D., *A Methodology for Systems Engineering*, Van Nostrand, Princeton, N.J., 1962.

Sage, Andrew P., *Systems Engineering*, New York: John Wiley & Sons, Inc., 1992.

Deming, W.E., *Out of the Crisis*, MIT Press, Cambridge MA, 1986.

Imai, Masaaki, *Kaizen, The Key to Japan's Competitive Success*, McGraw-Hill, New York, 1986.

Peters, T.J., and Waterman, R.H. Jr., *In Search of Excellence*, Harper and Row, New York, 1982.

Sage, Andrew P., *Methodology For Large-Scale Systems*, McGraw-Hill, New York, 1977.

Sage, Andrew P., *Systems Engineering: Methodology & Applications*, IEEE Press, New York, 1977.

Quade, E.S., *Analysis for Public Decisions*, North-Holland. New York, New York, 1989.

Saaty, Thomas L., and Alexander, J.M., *Thinking With Models: Mathematical Models in the Physical, Biological and Social Sciences*, Pergamon Press, New York, 1981.

Flood, R.L., and Carson, E.R., *Dealing With Complexity: An Introduction to the Theory and Application of Systems Science*, Plenum Press, New York, 1988.

Flood, Robert L., *Creative Problem Solving: Total Systems Intervention*, Wiley, New York, 1991.

Eisner, Howard, *Computer-Aided Systems Engineering*, Prentice-Hall, Englewood Cliffs, New Jersey, 1988.

Gohagan, John K., *Quantitative Analysis for Public Policy*, McGraw-Hill, New York, 1980.

Chen, G., Jamieson, J.M., Schkade, L.L., and Smith, C.H., eds, *The General Theory of Systems Applied to Management and Organization*, The Systems Inquiry Series, Intersystems Publications, Seaside California, 1980.

Jackson, M.C., Mansell, G.J., Flood, R.L., Blackham, R.B. and Probert, S.V.E., *Systems Thinking in Europe*, Plenum Press, New York, 1991.

Chapman, W., Bahill, A.T., and Wymore, W., *Engineering Modeling and Design*, CRC Press, New York, 1992.

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Hoos, Ida H., *Systems Analysis in Public Policy: A Critique*, University of California Press, Los Angeles, 1972.

Weinberg, Gerald M., *Rethinking Systems Analysis and Design*, Little, Brown, and Company, Boston, 1982.

Weinberg, Gerald M., *An Introduction to General Systems Thinking*, Wiley, New York, 1975.

Blanchard, B.S., and Fabrycky, W.J., *Systems Engineering and Analysis*, Prentice-Hall, Englewood Cliffs, New Jersey, 1990.

Churchman, W., *The Systems Approach and Its Enemies*, Basic Books, New York, 1979.

Churchman, W., *The Systems Approach*, Dell Publishing Company, New York, 1968.

Churchman, *The Design of Inquiring Systems: Basic Concepts of Systems and Organization*, Basic Books, New York, 1971.

Majone, G., and Quade, E., editors, *Pitfalls of Analysis*, Wiley-Interscience, New York, 1980.

Martin, James, *Systems Engineering Guidebook: A Process for Developing Systems and Products*, CRC Press, New York, 1997.

Eisner, Howard, *Essentials of Project and Systems Engineering Management*, Wiley, New York, 1997.

Reilly, Norman, *Successful Systems Engineering for Engineers and Managers*, Van Nostrand Reinhold, New York, 1993.