Syllabus for ME4913
Innovative Interdisciplinary Engineering
Spring, 2009

NYU·poly
POLYTECHNIC INSTITUTE OF NYU

Course Information

Instructor:	Dr. Maurizio Porfiri Email: mporfiri@poly.edu Office: RH504A Phone: 718-260-3681 Office Hours: Thursday 12:00-12:55	
Lecture:	Tuesday 3:00-4:50	RH302
	Friday 3:00-3:55	RH302
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Course Goals

The American Society of Mechanical Engineers (ASME) has recently indicated "the growing complexity and interdisciplinary foundations of engineered systems", "the blurring of boundaries among technical disciplines", "the convergence of biology and engineering", and "prospective students interests that go well beyond perceived boundaries associated with engineering disciplines traditional roles" as four out of the seven compelling reasons for a critical reexamination of engineering education. This course provides a sound starting point for leading the transition from the traditional mechanical engineering curriculum to the next level advocated by the ASME.

Prerequisites

MA2132, MA2012, and PH1004

Required Text

(AR) E. S. Allman and J. A. Rhodes, Mathematical models in biology, Cambridge University Pres, 2004

References

(P) W. J. Palm III, A concise introduction to Matlab, McGraw Hill, 2008
(KE) M. J. Keeling and K. T. D. Eames, Networks and epidemic models, Journal of the Royal Society Interface, 2005, vol. 2, pp. 295-307
(LAZ) M. F. Laguna, G. Abramson, and D. H. Zanette, Minorities in a model for opinion formation, Complexity, 2004, vol. 9, pp. 31-36

(CKJRF) I. D. Couzin and J. Krause and R. James and G. D. Ruxton and N. R. Franks, Collective memory and spatial sorting in animal groups, Journal of Theoretical Biology, 2002, vol. 218, pp. 1-11

Homework

Four homework will be assigned. Each homework assignment must be typed on a word-processor. Use of LaTeX is encouraged, although other word processing platforms are certainly acceptable. Students must hand-in their own work. Students are permitted to discuss homework questions with other students, although they are not permitted to discuss solutions except in general terms. No late homework will be accepted except for exceptional and documented circumstances. Solutions for all assigned problems will be provided, although not all assigned problems will necessarily be graded. Significant weight in grading will be placed on clarity of presentation.

Exams

There will be only one mid-term. The exam will be administered in class and will test the student's comprehension and ability to apply material learned in class and through assignments. The test is open book and closed notes. Formula sheets prepared by students will not be allowed. During the exam, before beginning to solve assigned problems, students should briefly restate the problem and list the data given. Also, students should list the important concepts and formulae used to arrive at the final solution along with detailed work. Every page of every exam submission should have the student full name and section number. Illegible work and loose sheets will not be graded. Students must complete the exam on their own. If a student cannot attend an exam due to a medical condition, certified by a doctor, he/she must notify the instructor in advance. Unexcused absence from an exam will result in a grade of 0 for that exam.

Project

One project will be assigned to every student team comprising 2-3 students. Each project must be typed on a word-processor. Use of LaTeX is encouraged, although other word processing platforms are certainly acceptable. Students will present their projects during the day of final exam and must turn their project to the instructor during that day.

Grading policy

Homework:	40%
Midterm Exam:	25%
Project:	35%

Extra credit

There are no opportunities for extra credit. The grading policy allows for a "bad score".

Class attendance and absences

There are no formal requirements for attendance, and there is no direct penalty for missing class. Students are strongly encouraged to attend class since some course material will only appear in lectures. Students that miss class are responsible for obtaining class notes from a classmate.

Honor system

The honor system is in strictly force for this course. It is assumed that all work submitted by a student is done so under the honor system code. **Homework questions may be discussed with students. Homework solutions may not be discussed.** The final exam must be completed individually.

ABET a-k criteria compliance

	a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	*k*
ME4913	✓			✓	✓		✓	✓	✓	✓	✓

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Tentative Lecture Schedule

Lecture	**Reading**	**Topic of the day**
Lecture 1 (T) 1/20/09	AR 1-11	Course overview and linear population models
Lecture 2 (F) 1/23/09	AR 41-85	Linear models of structured populations
Lecture 3 (T) 1/27/09	AR 41-85	Linear models of structured populations
Lecture 4 (F) 1/30/08	AR 41-85	Linear models of structured populations
Lecture 5 (T) 2/3/09	P 1-85 and 153-181	Introduction to Matlab and problems in linear population models (Lab module)
Lecture 6 (F) 2/6/09		Analysis of mechanical trusses
Lecture 7 (T) 2/10/09		Analysis of mechanical trusses
Lecture 8 (F) 2/13/09		Analysis of resistive networks
Lecture 9 (F) 2/20/09	AR 11-40	Nonlinear population models

Lecture	**Reading**	**Topic of the day**
Lecture 10 (T) 2/24/09	P 1-85 and 153-181	Problems in mechanical and electrical systems (Lab module)
Lecture 11 (F) 2/27/09	AR 11-40	Nonlinear population models
Lecture 12 (T) 3/3/09	AR 85-111	Nonlinear models of interactions
Lecture 13 (F) 3/6/09	P 1-85 and 153-181	Problems in nonlinear systems (Lab module)
Lecture 14 (T) 3/10/09		**Midterm exam**
Lecture 15 (F) 3/13/09	AR 279-313	Disease modeling
Lecture 16 (T) 3/24/09	AR 279-313	Disease modeling
Lecture 17 (F) 3/27/09	P 1-85 and 153-181	Problems in epidemiology (Lab module)
Lecture 18 (T) 3/31/09	LAZ	Material particles' collision and introduction to opinion dynamics
Lecture 19 (F) 4/3/09	LAZ	Opinion dynamics
Lecture 20 (T) 4/7/09	KE	Introduction to networks (Lab module)
Lecture 21 (F) 4/10/09		Network representation
Lecture 22 (T) 4/14/09	KE	Epidemics and opinion dynamics on complex networks
Lecture 23 (F) 4/17/09		Application of network theory to control of multivehicle teams
Lecture 24 (T) 4/21/09	CKJRF	Behavioral modeling of animal grouping
Lecture 25 (F) 4/24/09	CKJRF	Behavioral modeling of animal grouping
Lecture 26 (T) 4/28/09		Computer simulations of fish schooling (Lab module)