ECE 5550: Computational Humanitarianism

Course Description

Computational models of individual and group poverty and underdevelopment; computational social justice; assessing social impact of technology; sensitivity analysis for technology prioritization and design; feedback control for computer automation of helping to meet social justice objectives; social agreement, choice, and allocation.

Prior Course Number: 5194.06
Transcript Abbreviation: Comp Humanitarian
Grading Plan: Letter Grade
Course Deliveries: Classroom
Course Levels: Undergrad, Graduate
Student Ranks: Junior, Senior, Masters, Doctoral
Course Offerings: Autumn
Flex Scheduled Course: Never
Course Frequency: Even Years
Course Length: 14 Week
Credits: 3.0
Repeatable: No
Time Distribution: 3.0 hr Lec
Expected out-of-class hours per week: 6.0
Graded Component: Lecture
Credit by Examination: No
Admission Condition: No
Off Campus: Never
Campus Locations: Columbus
Prerequisites and Co-requisites: Enrollment in the College of Engineering, and junior, senior, or grad standing; or permission of instructor.
Exclusions: Not open to students with credit for 5194.06.
Cross-Listings:

Course Rationale: To support developing program in Humanitarian Engineering at OSU that has significant

student interest.

The course is required for this unit's degrees, majors, and/or minors: No
The course is a GEC: No
The course is an elective (for this or other units) or is a service course for other units: Yes

Subject/CIP Code: 14.1001
Subsidy Level: Doctoral Course

Programs

Abbreviation	Description
CpE	Computer Engineering
EE	Electrical Engineering

General Information

Helps meet criteria 3 a, c, e, f, g, h, j, and k. Cultural, political, economic, global, societal, and contemporary issues arise in concrete ways in simulations and analysis of technologies embedded in social systems.
Student interest: Students studying humanitarian engineering, feedback control systems, dynamical systems, distributed systems, decision-making systems, and simulation. Students who have taken ENGR 5050. Students from student service organizations (e.g., ECOS, EWB, ESW, SEO), students seeking technical electives, and graduate students. Advanced students from the social sciences, particularly social work, sociology, psychology, economics, political science.

Course Goals

Models and computational analysis of aspects of human development.
Matlab for computational evaluations.

Course Topics

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
1. Introduction a. Overview b. Elements of Matlab/Simulink c. Elements of Monte Carlo simulation, and statistics	3.0							
2. Models of poverty and financial management a. Modeling income and cash-in-hand b. Model of capital, loans, savings	3.0							
3. Feedback control for finance management a. PID b. Model predictive control c. Adaptive control d. Stochastic dynamic programming	3.0							
4. Community model, wealth distribution strategy a. Personal finance management and donations b. Distributive justice and wealth distribution policies c. Distributed policy performance, impact of topology and delays	3.0							
5. Wealth, reputation, and cooperation in a community a. Community model with wealth and reputation b. Performance of community	3.0							
6. Democracy model and analysis a. Modeling democracy, individual vote determination b. Modeling vote aggregation, and evaluation of performance	3.0							
7. Development and technology diffusion models a. Models of economic growth, poverty traps b. Nonlinear analysis: equilibria, stability, sensitivity c. Integrated poverty-trap / technology diffusion ODEs	3.0							
8. Environment models, policy, regulation a. Renewable resource model, ODE, tragedy of the commons b. Environmental justice policy c. Regulation of environmental use	3.0							
9. Cooperative management of community technology a. Management via people vs. automation approach b. Cooperative pricing strategies, distribution c. Simulation and evaluation of management	3.0							
10. Community model, wealth, health, education, environment a. Nonlinear difference equation model of wealth, health, education, and environment coupled together b. Impact of production technology improvement	3.0							

Topic	Lec	Rec	Lab	Cli	IS	Sem	FE	Wor
11. Assessing community development a. A sustainable community development index (SCDI) b. Impact of technologies on SCDI: production, health, education, resource efficiency	3.0							
12. Development as a feedback control process a. Model of long-term growth b. Model of feedback control for regulation of technology quality to promote long-term development as measured by the SCDI	3.0							
13. Model and analysis of human development and values a. Spaiser et al paper b. Simulation evaluation	3.0							
14. Overview of research directions in computational humanitarianism a. Distributed community financial management, apps b. Model development	3.0							

Representative Assignments

Homeworks: 45%, 6 simulations, new simulations or modifications of Simulink simulation diagrams used to develop class lectures.
Midterm Project: 25%, Development of an automation strategy for an individual and its evaluation via Monte Carlo simulation.
Final Project: 30%, Development of a distributed automation strategy for a community and its evaluation via Monte Carlo simulation.

Grades

Aspect	Percent
Homework	45%
Midterm project	25%
Final project	30%

Representative Textbooks and Other Course Materials

Title	Author
No text exists	

ABET-EAC Criterion 3 Outcomes

Course Contribution		College Outcome
*	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.

Course Contribution		College Outcome
*	j	A knowledge of contemporary issues.
**	k	An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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