THE UNIVERSITY OF HONG KONG
FACULTY OF BUSINESS AND ECONOMICS

PhD Course Syllabus

Course Code/Title: **ECON6096 Computational Methods in Economics**

Course Description: In modern economic research, computers enhance our capacity of solving complex problems. Computation is particularly important in fields involving massive data. The objective of this course is to introduce graduate students to computational approaches for solving economic models, with an emphasis on dynamic programming and simulation-based econometric methods. We will formulate economic problems in computationally tractable form and use techniques from numerical analysis to solve them. The substantive applications will cover a wide range of problems including labor, industrial organization, macroeconomics, and international trade.

Course Objectives: Computational economics has not been part of the core curriculum of postgraduate-level economics education, whereas programming skill is critical for a postgraduates success in academia and industry. This course intends to teach students computational methods for solving economic problems, and expose students to extensive programming exercises. We expect that at the end of the course a student would proficiently use Matlab, a commonly used programming language in economic research. Moreover, we aim to equip the students with the computational ability to tackle problems of their own research areas.

Pre-requisite: Knowledge of advanced level of microeconomics, macroeconomics, and econometrics

Assessment: 70% coursework; 30% examination

Remarks: All PhD courses are non-credit-bearing and will be assessed on a pass/fail basis.

Course Learning Outcomes (CLOs)	Aligned PLOs*				
On completion of this course, students should be able to:	1	2	3	4	5
1. Master a new programming language Matlab	x		X		
2. Learn computational methods for solving economic problems	X		X		x
3. Apply computational methods to solve an economic project	x	X		X	x
4.					
5.					

***Programme Learning Outcomes (PLOs) for Research Postgraduate Programme:**

1. Demonstrate critical understanding, at an advanced level, of up-to-date knowledge and research methodology of a particular field
2. Implement effective academic and personal strategies for carrying out research projects independently and ethically
3. Contribute original knowledge in response to issues in their specialist area
4. Communicate research findings at a diverse range of levels and through a variety of media
5. Evaluate one's own research in relation to important and latest issues in the field

COURSE DETAILS *(subject to change at instructor's discretion)*

Year/Semester:	2023-24, Second Semester
Time/Venue:	Day, Time, Venue
Instructor:	Naijia Guo Email: njguo@hku.hk Office: KKL-xxx (by appointment)

I. Teaching and Learning Activities

In-class and Out-of-class Activities *(e.g. lectures, class discussion, papers reading, proposal writing)*	Expected hour	% of student study effort
1. Lectures	33	40
2. Student presentation	10	20
3. Papers reading	10	10
4. Final project	20	30
Total		100%

II. Assessment

Assessment Components *(e.g. assignments, proposal, presentation, examination)*	Weight	CLOs to be assessed				
		1	2	3	4	5
1. Midterm exam	30	X	x	x	x	x
2. Final project	70	x	x	X	x	x
3.						
4.						
Total	100%					

Students will be assessed based on the following performance standards:

Course Grade	Performance Standard
Pass	
Fail	

The midterm exam is an in-class exercise to test students' proficiency on using Matlab. The final project is a group project of 2-3 people. Students need to write a computer program to solve one of the two problems (micro or macro). Students will make a presentation about their results and hand in the report with codes and results.

III. Course Content and Tentative Schedule

Weeks 1-2 Matlab

Week 3-4 Linear and Non-linear Equations

Week 5 Optimization

Week 6 Midterm

Week 7 Monte Carlo Simulation

Week 8 Numerical Integration and Differentiation

Week 9 Approximation Methods

Week 10-11 Dynamic Programming

Week 12 Presentation of final projects

IV. Required/Recommended Readings

Required readings:

Judd, Kenneth (1998): Numerical Methods in Economics, the MIT Press

Recommended readings:

Altonji, J. G., Segal, L. M. (1996). Small-sample bias in GMM estimation of covariance structures. Journal of Business and Economic Statistics, 14(3), 353-366.

Athey, S. (2018). The impact of machine learning on economics. In The Economics of Artificial Intelligence: An Agenda. University of Chicago Press.

Pakes, A., Pollard, D. (1989). Simulation and the asymptotics of optimization estimators. Econometrica, 1027-1057.

Powell, W. B. (2007). Approximate Dynamic Programming: Solving the curses of dimensionality (Vol. 703). John Wiley & Sons.

Rust, J. (1994). Structural estimation of Markov decision processes. Handbook of econometrics, 4, 3081-3143.

Su, C. L., Judd, K. L. (2012). Constrained optimization approaches to estimation of structural models. Econometrica, 80(5), 2213-2230.

V. Course Policy

The University Regulations on academic dishonesty will be strictly enforced! Academic dishonesty is behaviour in which a deliberately fraudulent misrepresentation is employed in an attempt to gain undeserved intellectual credit, either for oneself or for another. It includes, but is not necessarily limited to, the following types of cases:

a. Plagiarism - The representation of someone else's ideas as if they are their own. Where the arguments, data, designs, etc., of someone else are being used in a paper, report, oral presentation, or similar academic project, this fact must be made explicitly clear by citing the appropriate references. The references must fully indicate the extent to which any parts of the project are not one's own work. Paraphrasing of someone else's ideas is still using someone else's ideas, and must be acknowledged. Please check the University Statement on plagiarism on the web: http://www.hku.hk/plagiarism/

b. Unauthorized Collaboration on Out-of-Class Projects - The representation of work as solely one's own when in fact it is the result of a joint effort.

c. Cheating on In-Class Exams - The covert gathering of information from other students, the use of unauthorized notes, unauthorized aids, etc.

d. Unauthorized Advance Access to an Exam - The representation of materials prepared at leisure, as a result of unauthorized advance access (however obtained), as if it were prepared under the rigors of the exam setting. This misrepresentation is dishonest in itself even if there are not compounding factors, such as unauthorized uses of books or notes.

You are expected to do your own work whenever you are supposed to. Incident(s) of academic dishonesty will NOT be tolerated. Cheating or plagiarism of any kind would result in an automatic FAIL grade for the course plus strict enforcement of all Faculty and/or University regulations regarding such behaviour.