2021

GLOBEX

暑期项目 Globex Julmester Program

College of Engineering

PEKING UNIVERSITY

2021 GLOBEX PROGRAM AT PEKING UNIVERSITY, CHINA

The Globex at the College of Engineering, Peking University is a professional mobility program with a worldwide exchange of students from all disciplines of study. To enhance students' global and professional experience, Globex offers courses that focus on: 1) engineering & science, 2) innovation & entrepreneurship, and 3) society & globalization. Engineering and science generate new knowledge and skills for society to advance and prosper. To convert into useful products, the acquired knowledge and skills need to be commercialized through innovation and entrepreneurship. Societies everywhere are being profoundly impacted by China, as it grows to become the world's largest economy. Globex offers students an opportunity to study China and its culture from engineering perspective. Globex students can select 1 or 2 courses (3-6 credits) from the various themes (one in the morning and the other in the afternoon).

Program Start-End Dates

- First & last day of class: Monday, July 5, 2021 & Friday, July 23, 2021.
- Final exams are scheduled on Saturday, July 24, 2021.

Online Application Deadline and Tuition Payment Deadline

- Registration must be done online and it requires a compulsory payment of RMB 300
- Students who join the online program will enjoy 20% discount of tuition payment. (Globex tuition: RMB 0-12000).
- Online Application Deadline: May 31, 2021
- Tuition Payment Deadline: May 31, 2021

Miscellaneous Info

- Globex will provide course syllabi and PKU transcript to facilitate course credit transfer, it does not however, guarantee that the credits will be acceptable by the student's home university.
- Official PKU transcript and certificate of completion will be offered in 2021 September.

Program Website & Contact Info

- Globex Website: http://globex.coe.pku.edu.cn/
- Email Inquiry: globex@pku.edu.cn

No.	Category	Course	Instructor	Organization	Class Time Mon-Fri
1	Engineering & Science	Applied Analysis for Engineering Sciences 工程科学应用分析	TANG Shaoqiang	Peking University, China	AM
2		Intelligent Manufacturing: Data Science and Process Models 智能制造：数据科学与过程模型	Andrew KUSIAK	The University of Iowa, USA	AM
3		Fundamentals of Control Theory 控制理论基础	HUANG Xun	Peking University, China	PM
4		Simulation Methods for Optimization and Learning 优化与学习模拟方法	Bernd HEIDERGOTT	Vrije Universiteit, Amsterdam, the Netherlands	PM
5		Sustainability Theory and Practices 可持续性理论与实践	Rod BAIN	University of Strathclyde, UK	PM
6	Innovation & Entrepreneurship	Financial Decisions in Engineering Project Management 工程项目管理中的金融决策	Daricha SUTIVONG	Chulalongkorn University, Thailand	PM
7	Society & Globalization	China Economy: Growth and Global Connections 中国经济：增长与全球联系	Susan MAYS	University of Texas Austin, USA	AM

- All courses are 3 credits unless indicated.
- Morning classes time: 9-12 AM, GMT+8:00 Beijing Time. Afternoon classes: 3-6 PM, GMT+8:00 Beijing Time.

Applied Analysis for Engineering Sciences
工程科学应用分析

TANG Shaoqiang

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Department of Mechanics and Engineering Science

College of Engineering, Peking University

Dr. Tang earned PhD in Applied Mathematics, HKUST. His research areas focus on Computational Mechanics and Applied Mathematics: multiscale simulations, scientific computing. He teaches both undergraduate and graduate courses such as Calculus, Applied Analysis, Scientific Computing, Numerical Methods, Multiscale Algorithms et al. He was honored the Teacher of Excellence Award by Beijing Municipal Government in 2013.

Synopsis

The objectives of this course include: to show some modern (1900-1990) mathematical methods that are widely used in engineering sciences, nonlinear mechanics and other physical sciences; to help initiating research activities, namely, to boost ideas, to formulate the problem, and to explore the mathematics; to help bridging the gap between the mathematical tools and the physical understandings.

Audience

Year 3 &4 Undergraduate and Graduate Students

Prerequisites needed: Calculus (Single variate, and multi-variate), Linear Algebra, Ordinary Differential Equations.

Schedule

Class: 9-12 AM (Beijing Time), M-F, July 5-23, 2021

Total Contact Hours: 45

Topics

1. The qualitative theory of Ordinary Differential Equations (ODE) systems
   a) The second order ODE (plane analysis)
   b) Stability analysis via the Lyapunov function
   c) Chaos in the Lorenz system and the logistic map
2. Reaction-diffusion systems
   a) BVP (boundary-value problem) and IBVP (initial boundary-value problem)
   b) Traveling wave analysis
   c) Burgers' equation and Cole-Hopf transform
   d) Evolutionary Duffing equation
3. Hyperbolic equations
   a) Linear advection equation
   b) Discontinuities in inviscid Burgers' equation
   c) Elementary waves in a polytropic gas
   d) Soliton and inverse scattering transform

Reference

Shaoqiang Tang, Applied Analysis for Engineering Sciences, Peking University Press, 2016, http://www.pup.cn/scrp/bookdetail.cfm?iBookNo=92785&sYc=1

Grading

40% Homework Assignments

60% Exam (open-book)

100% Total

Intelligent Manufacturing: Data Science and Process Models

智能制造：数据科学与过程模型

Andrew KUSIAK

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Department of Mechanical and Industrial Engineering

The University of Iowa, USA

Dr. Kusiak has chaired two departments, Industrial Engineering (1988-95) and Mechanical and Industrial Engineering (2010-15), at the Univ. of Iowa. He is the Director of the Intelligent Systems Laboratory. His research interests include applications of computational intelligence and big data in automation, manufacturing, product development, renewable energy, sustainability, and healthcare. He has published numerous books and hundreds of technical papers in journals sponsored by professional societies.

Synopsis

Manufacturing and service industry is undergoing a transformation towards greater service orientation and autonomy. The use of sensors and wireless technologies capturing data is growing across industries. New configurations of systems emerge. Models, methodologies, and algorithms in support of design and analysis of intelligent manufacturing systems are introduced. Data science and process models for cloud applications are emphasized.

Audience

Year 3 & 4 Undergraduate and Graduate Students

Schedule

Class: 9-12 AM (Beijing Time), M-F, July 5 –July 23, 2021
Total Contact Hours: 45

Topics

1. Introduction to intelligent manufacturing
2. Digitization of manufacturing
3. Systems modeling
4. System analysis
5. Process structure optimization
6. Decomposition in systems engineering
7. Reliability and quality analysis
8. Operational performance
9. Data science
10. Evolutionary computation in intelligent manufacturing
11. Emerging developments in intelligent manufacturing
12. Innovation science

Note

Students need to bring their own laptops for this course

Grading

20% Homework assignments
20% Quizzes
30% Classroom exercises
30% Project
100% Total

Fundamentals of Control Theory

控制理论基础

HUANG Xun

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Department of Aeronautics and Astronautics

College of Engineering, Peking University

Dr. Huang earned his PhD from Aeronautics and Astronautics, University of Southampton, United Kingdom. His research areas include Aeroacoustics, flow control, flight control, array signal processing. He teaches 7 coures at PKU including Aeroacoustics, Active Control and Signal Processing, Control Theory, Circuits and Electronics, Flight control and simulation, Computational Aeroacoustics and Nanosatellite Engineering. Dr. Huang has won the first prize in the Young Teachers' Teaching Competition at Peking University.

Synopsis

Introduce the fundamentals of classical and modern control theories to undergraduates in Engineering. The graduate students in dynamics and control are also welcomed if their undergraduate trainings were not in control. The pre-requisite course is calculus and linear algebra. Knowledge in electronic circuits and signal and processing will be helpful too, but will be summarized in this tutorial when it is necessary. In addition, the emerging machine learning-based control methods will be introduced, mainly through the successful completion of the designed software tasks. Hence, students are expected to have experience with Python or other similar programming language.

Audience

Year 2 to 4 Undergraduate and Graduate Students

Schedule

Class: 3-6 PM (Beijing time) M-F, July 5 – 23, 2021
Total Contact Hours: 45

Objective

Students learn how to model and analyze real-life problems from the perspective of control and the fundamental modeling and control methods. The knowledge can be demonstrated by completing an inverted pendulum example and, later, could be further extended to more practical design examples.

Topics

1. Introduction
2. Mathematical model of system
3. Time domain analysis
4. Frequency domain analysis
5. Loop shaping
6. Fundamentals of nonlinear system control
7. State space representation
8. Observability and Controllability
9. Regulator
10. Examples

Reference

Dorf R.C., Bishop R.H. Modern Control Systems, 12th edition.
Lecture notes will be provided.

Grading

0%	Homework problems (Only for self evaluation)
30%	Mid exam
30%	Experiential learning report
40%	Final exam
100%	Total

Simulation Methods for Optimization and Learning

优化和学习的模拟方法

Bernd HEIDERGOTT

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Department of Econometrics and Operations Research

Vrije Universiteit, Amsterdam, the Netherlands

Dr. Heidergott earned his PhD from the Center of Mathematical Statistics and Stochastic Processes, Department of Mathematics, University of Hamburg. He teaches mathematics and statistics for economists, Convex Analysis and Optimization for econometricians. He has received the Best Lecturer Award of the faculty of Economics and Business Administration of the VU for the academic year 2008/2009. His main current research directions are gradient estimation, differentiation theory, Taylor series expansions and Max-plus algebra.

Synopsis

This course gives a broad treatment of the important aspects of the use of computer simulation for the analysis and optimization of dynamic stochastic models. The emphasis is on modeling the stochastic system as a discrete event dynamic system, and analyzing and improving its performance by means of discrete event simulation. Applications will stem from a wide range of domains: from Social Networks to Computer Networks, and Financial Engineering to Business Processes. The course will introduce students to the use of computer simulation in analyzing dynamic stochastic models through simulation-based methods for optimization and learning. The leading question of the course is how to use simulation to make better and more responsible decisions for real-life problems. The course will also reflect on the technological and mathematical developments we witness in our societies. While actively working on simulation projects, the course will provide space for reflecting on the mathematical/technological paradigm. That is, next to learning the actual techniques, students will be stimulated to reflect on the history of science and the technological developments around them. The course will have several guest lectures on specific topics by experts in their field.

Audience

Year 3 &4 Undergraduate and Graduate Students

Schedule

Class: 3-6 PM (Beijing Time), M-F, July 5 – 23, 2021
Total Contact Hours: 45

Objective

Students learn how to model and analyze real-life problems by Monte Carlo simulation. After successful completion of this course, students will be able to conduct a Monte Carlo simulation based analysis of a problem, provide an output analysis, and place their research into the broader historical and societal context.

Topics

1. Programming language is Python (basic programs will be provided). Other programming languages, such as Matlab, are also fine but are not supported.
2. Basics of Monte Carlo Simulation: random number generation, discrete event simulation, output analysis
3. Standard simulation models: queuing systems, social networks, financial products, inventory systems, news vendor problem
4. Data and simulation: combining simulation with available historical data
5. Estimation of gradients via simulation and their application in learning and optimization: stochastic gradient method, stochastic approximation, supervised learning, non-supervised learning

Reference

Material will be provided during the course.
Additional recommended reading:
Handbook of Monte Carlo Methods, D. Kroese, T. Taimre, Z. Botev, Wiley, 2011
Chapters 1,2,5,6,7,8,9 of Simulation Modeling and Analysis, A. Law, Mc Graw Hill, 4-th or 5-th edition. Chapter 11 of Introduction to Discrete Event Systems, C. Cassandras and S. Lafortune, Springer, 2nd edition 2008.

Grading

30% Presentation and written report
30% Simulation project written report
30% Final exam
10% Attendance and discussion
100% Total

Note

Students need to bring their own laptops for this course

Sustainability Theory and Practices

可持续性理论与实践

Rod BAIN

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Center for Sustainable Development

University of Strathclyde, UK

Dr. Bain is an experienced sustainability teacher and manager. Having worked in environmental and creative industries project management, he brings relevant, real world experience to teaching. Rod specializes in supporting students to deepen their understandings of sustainability, with a particular focus on sustainable business, innovation, creativity, and entrepreneurship, and on biodiversity governance and natural climate solutions. Rod has taught at the universities of Strathclyde, Manchester, Edinburgh, St Andrews, and Uppsala. When not at work, Rod spends his free time in the outdoors - mountaineering, skiing, cycling, running, and sailing - and enjoying the natural world.

Synopsis

This course will introduce students to sustainability in the context of energy supply and demand both now and in the future. Using case studies and practical examples, the course will focus on sustainability theory and practice, current and future energy demands in terms of CO2 emissions and climate change, future challenges and opportunities in the energy sector for high and low income countries, trans/interdisciplinary and cross sectoral engagement in the development of energy solutions, and how these solutions may affect society, economies and the environment. This course will be led by Dr Rod Bain and will feature lectures from a range of experts from across the university.

Audience

Year 3 & 4 Undergraduate and Graduate Students

Objective

To develop an understanding of the principles of sustainability, and how the many facets of sustainability relate to the current and future demand for energy.

Topics

1. Understanding the principles of sustainability
2. Sustainability and systems thinking
3. Introduction to key sustainability issues around energy
4. Current and future energy demands
5. Energy system transitions and sustainability
6. Energy justice through the system transition

Reference

Material will be provided during the course

Additional recommended reading:

Cohen, M.J. (2021) Sustainability. Cambridge: Polity Press. https://politybooks.com/subjectlanding/index.php/bookdetail/?isbn=9781509540310&subject_id=9&tag_id=77 .

Grading

90% 3 x weekly assessments

10% Attendance and Participation

100% Total

Financial Decisions in Engineering Project Management
工程项目管理中的金融决策

Daricha SUTIVONG

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Department of Industrial Engineering

Chulalongkorn University, Thailand

Dr. Sutivong earned her PhD in Management Science and Engineering from Stanford University, Master in Engineering Economic Systems and Operations Research from Stanford University, and Master in Electrical Engineering and Computer Science from MIT. Her research interests mainly focus on Engineering economic analysis and modeling, information technology investment, information markets, economics of electricity and energy, decision analysis and risk management.

Synopsis

The course introduces widely-used financial techniques for project evaluation. Based on the time value of money concept, the course examines how to analyze and valuate various cash flow patterns and provides popular economic measures for project assessment and selection, including the net present value and the rate of return, along with the application criteria for single and multiple project decisions. The course also addresses decision under uncertainties using techniques such as breakeven analysis, sensitivity analysis, decision tree, etc. Students will have an opportunity to perform a financial analysis of their interested problem in a group project and create management report and presentation.

Audience

Undergraduate and Graduate Students (all majors and all levels) with no prerequisites

Schedule

Class: 3-6 PM (Beijing time), M-F,July 5 -23, 2021
Total Contact Hours: 45

Objective

To develop an understanding of financial techniques used for project evaluation, project selection and decision under risk and uncertainties. Students will apply their knowledge to a real-world problem in a team environment.

Topics

1. Time Value of Money, Interest Rate, Economic Equivalence, Simple and Compound Interests
2. Cash Flow Analysis and Valuation: Single Cash Flows, Cash Flow Series
3. Nominal and Effective Interest Rates: Discrete Time Period, Continuous Compounding
4. Present Value Analysis: Equal-life Alternatives, Different-life Alternatives, Capitalized Cost, Payback Period
5. Annual Value Analysis: Capital Recovery, Equivalent Annual Value
6. Rate of Return Analysis: Single Alternative
7. Rate of Return Analysis: Multiple Alternatives
8. Breakeven Analysis: Single and Multiple Alternatives
9. Decision under Uncertainties: Sensitivity Analysis, Three Estimates, Expected Value Decision, Decision Tree
10. Financial Analysis Modeling
11. Creating Report and Presentation for Management

Grading

25% Quiz 1 (Topic 1-3)
35% Quiz 2 (Topic 4-7)
30% Group Project Presentation and Report
10% Attendance and Participation
100% Total

China Economy: Growth and Global Connections

中国经济：增长与全球联系

Susan MAYS

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Center for Asian American Studies

The University of Texas at Austin, USA

Dr. Mays holds a PhD from Columbia University in Global Economic History (Asia/China focus), an MA from Harvard University in East Asian Studies (China focus), an MS from Stanford University in Engineering-Economic Systems, and a BS from Purdue University in Engineering. Prior to academia, Dr. Mays worked in business and technology with Fortune 500 companies initially as an engineer and later as a management consultant with Kearney. Dr. Mays' primary focus is economic and technological development in Asia, particularly China. Her interdisciplinary projects have addressed high technology sectors in China/East Asia including how global trade, investment, and supply chains influence organizations and human capital. She focuses on macro-economic trends and trends in business, technology, and human resources.

Synopsis

This course addresses economic development in China, in global context. The course examines trends in trade, foreign investment, ownership (i.e., public vs. private), finance, the workforce, and consumption, as well as key business sectors. The class also considers challenges and opportunities in China in the areas of environment, energy, education, and healthcare. Taught by an economic historian, the course considers China's unique history, culture, and business context, as well as global partnerships and influences. The reading and course materials are by scholars, leaders in business, economics and policy, as well as journalists.

Audience

Undergraduate and Graduate Students (all majors and all levels) with no prerequisites

Schedule

Class: 9-12 AM (Beijing time), M-F, July 5 -23, 2021
Total Contact Hours: 45

Topics

1. China's Reform and Opening from 1978 and Chinese Governance
2. Rural-to-Urban Labor Migration, Export-led Development, and Foreign Trade
3. Business Ownership (private, state-owned, Sino-foreign joint ventures, foreign owned)
4. Financial Services and the Legal System
5. High Tech Sectors and Entrepreneurship
6. The Education System and China's Talent Pool
7. Energy and Environmental Challenges
8. Family Economics and the Healthcare Industry
9. The Foreign Sector in China and Chinese Investments Abroad
10. Infrastructure Initiatives

Grading

75% 3 Weekly Quizzes (multiple choice and one essay)
25% Group Project
100% Total


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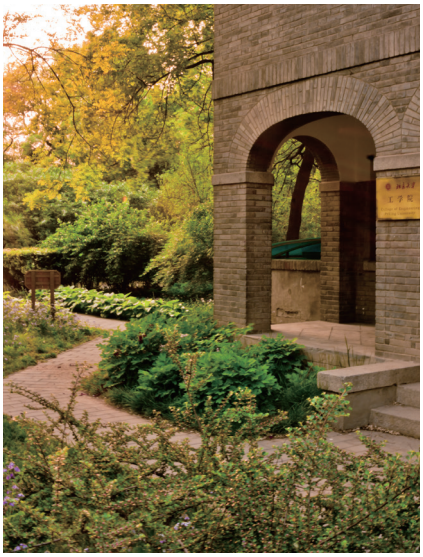


Globex Julmester 2019 Welcome Ceremony
College of Engineering, Peking University

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