INTERNATIONAL SUMMER/WINTER PROGRAMMES (i-SP)

IMPORTANT NOTE
Before applying for any summer/winter programme, read the GRO website for important information on:

- General Eligibility Requirements and Application Process
- Module Mapping and Financial Aid
- Visa Application, Travel Advisories and Student Insurance

Peking University GLOBEX Program 2020
(Updated as of 7 Jan 2020)

Host University Website: [http://globex.coe.pku.edu.cn/](http://globex.coe.pku.edu.cn/)
Programme Location: Beijing, China
Programme Dates: 29 Jun – 18 Jul 2020;
Optional 3-day pre-Globex Beijing tour 26 - 28 Jun 2020;
Optional 3/5-day post-Globex field trip 19 - 21 Jul / 19 - 23 Jul 2020
Application Deadline: 10 Apr 2020 in EduRec;
15 Apr 2020 for PKU Globex
No. of Placements: Unlimited

ESTIMATED COST OF PARTICIPATION

| 1 | Programme Fee | Partially subsidised fee of RMB 6,000 for NUS students regardless of the number of courses. | Students who accept internal offer in EduRec by 15 Apr 2020 will be nominated by NUS GRO to enjoy subsidised fee offered by PKU Globex. |

| 2 | Projected Expenditure | [Click here](http://globex.coe.pku.edu.cn/) to find additional estimates for airfare, private accommodation and personal expenses for various cities. |

<table>
<thead>
<tr>
<th>Item</th>
<th>Estimated Cost (SGD)</th>
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<tbody>
<tr>
<td>Registration fee (non-refundable)</td>
<td>$58 (RMB300)</td>
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<tr>
<td>Programme fee*</td>
<td>$1,160 (RMB6,000)</td>
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<tr>
<td>Accommodation (Type A; double occupancy @RMB110 per day at Beijing Post &amp; Telecom Conference Center for 22 days)</td>
<td>$470 (RMB2,420)</td>
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<tr>
<td>Beijing tour (optional) Pre-GLOBEX Beijing Tour</td>
<td>$190 (RMB980)</td>
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<tr>
<td>Field trip (optional) Post-GLOBEX field trip</td>
<td>$545 - $610 (RMB2,800 – 3,150)</td>
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</tbody>
</table>

*partially subsidised tuition fee offered by PKU Globex and regardless of number of courses

<table>
<thead>
<tr>
<th>3</th>
<th>Financial Aid Available Through NUS GRO</th>
<th>As a participant of this programme, you are eligible to apply for:</th>
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<tbody>
<tr>
<td></td>
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<td>NASA Enhancement Bursary <em>(Singapore Citizens only)</em></td>
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<td>China Initiatives Steering Committee Funding <em>(Singapore Citizens &amp; PRs only)</em></td>
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<td>Overseas Student Programme Loan <em>(Singapore Citizens only)</em></td>
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<td>PSEA Fund Withdrawal <em>(Singapore Citizens only)</em></td>
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<td></td>
<td>PROGRAMME DETAILS</td>
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<tr>
<td>4</td>
<td><strong>Academic Content</strong></td>
<td>PKU Globex offers about 15 courses in July for 3 weeks, each course 3 credits (45 hours). 70% of the courses focus on Engineering and Science, the others 30% are about Innovation and Entrepreneurship, and China-focused topic. Details of academic content and other aspects of this programme are available at <a href="http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm">http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm</a></td>
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<tr>
<td>5</td>
<td><strong>Eligibility Requirements</strong></td>
<td>NUS’ generic eligibility requirements apply, please see <a href="http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm">GRO website</a> for details. <strong>This programme is accepting students of Chinese nationality.</strong></td>
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<tr>
<td>6</td>
<td><strong>Accommodation</strong></td>
<td>Refer to the <a href="http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm">host university website</a> for the accommodation arrangements/recommendation. Students must submit hotel booking info through the Globex website for the Globex office to help with booking of the hotel. Students can use own ID to check in directly when arrived in Beijing and credit card to pay for the room. Payment will be in RMB. The hotel will charge some amount for the room card deposit when at check in.</td>
</tr>
<tr>
<td>7</td>
<td><strong>Application Procedure</strong></td>
<td>• Apply in <a href="http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm">NUS Education Records System (EduRec)</a> in order to proceed with module mapping, submission financial aids application; • Students must accept internal offer in EduRec in order to be nominated by NUS GRO for partially subsidised tuition fee offered by PKU Globex; • Apply for the PKU Globex by registering at <a href="http://register.pkuglobex.cn/member/my.php">http://register.pkuglobex.cn/member/my.php</a> • Accept both the EduRec offer as well as the host university offer to confirm your participation in this programme.</td>
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<tr>
<td>8</td>
<td><strong>Module Mapping</strong></td>
<td>Students interested in obtaining credit can start the module mapping process after you apply in EduRec and accept the offer for the programme. Module mapping request is subjected to approval from the Faculties. Click here for a step-by-step guide on applying for module mapping. Also note the following: A total of 12 MCs from a maximum of 2 overseas summer/winter and research programmes can be mapped without having to pay NUS tuition. Additional MCs mapped will be subjected to Special Term fees. For details, visit the <a href="http://globex.coe.pku.edu.cn/globexcourses/syllabus/index.htm">Registrar’s Office website</a>.</td>
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</table>

### ADDITIONAL INFORMATION

<p>|   | Visa Application | Successful applicants will receive an admission package which include JW202 Form and Admission Notice for visa application. |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Section</th>
<th>Content</th>
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<tbody>
<tr>
<td>9</td>
<td>Visa</td>
<td>You will require X2 visa to enter China and participate in this programme. The documents you require for your visa application will be provided after the host university accepts you and you have paid the programme fee. For information on visa application in Singapore, please refer to <a href="http://www.visaforchina.org/SGP_EN/generalinformation/visaknowledge/260894.shtml">http://www.visaforchina.org/SGP_EN/generalinformation/visaknowledge/260894.shtml</a></td>
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<td>10</td>
<td>Travel Advisories</td>
<td>Visit the <a href="http://www.mfa.gov.sg">MFA website</a> for travel advisories on various countries from the Singapore government.</td>
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<tr>
<td>11</td>
<td>Student Insurance</td>
<td><a href="http://www.visaforchina.org/SGP_EN/generalinformation/visaknowledge/260894.shtml">Insurance coverage for official NUS trips</a> is provided for your participation in this programme. During Globex enrollment, students will be required to furnish evidence or proof of medical insurance coverage for the entire duration of your stay in China. Please print a copy of the Insurance Policy and Insurance coverage (through above link) or submit a request for <a href="http://www.visaforchina.org/SGP_EN/generalinformation/visaknowledge/260894.shtml">Certificate of Insurance for Overseas University &amp; Visa/Permit Application</a>.</td>
</tr>
<tr>
<td>12</td>
<td>Contact Information</td>
<td>Questions about the programme? Contact the host university at: <a href="mailto:globex@pku.edu.cn">globex@pku.edu.cn</a> Questions about module mapping? Visit this <a href="http://www.visaforchina.org/SGP_EN/generalinformation/visaknowledge/260894.shtml">webpage</a>. Questions specific to NUS GRO? Contact us at: <a href="mailto:askGRO">askGRO</a></td>
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2020 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 Website & Contact Information**

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

**Online Application Deadline and Tuition & Other Fee Payment Deadline**

- Online Application Deadline: **April 15, 2020**
- Tuition and Other Fee Payment Deadline: **April 30, 2020**

**Program Start-End Dates**

- First & last day of class: **Monday, June 29, 2020 & Friday, July 17, 2020.**
- Final exams are scheduled on **Saturday, July 18, 2020.**
- The 3-day Pre-Globex Beijing Tour goes from June 26-28, 2020 and to participate in the tour, you need to arrive on **June 25, 2020.**
<table>
<thead>
<tr>
<th>No.</th>
<th>Category</th>
<th>Course (3 credits)</th>
<th>Instructor</th>
<th>Organization</th>
<th>Class Time Mon-Fri</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Engineering &amp;</td>
<td>Simulation Methods for Optimization and Learning  优化与学习模拟方法</td>
<td>Bernd HEIDERGOTT</td>
<td>Vrije Universiteit, Amsterdam, The Netherlands</td>
<td>AM 9-12</td>
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<td></td>
<td>Science</td>
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<td>2</td>
<td>Apply Analysis</td>
<td>Applied Analysis for Engineering Sciences 工程科学应用分析</td>
<td>TANG Shaoqiang</td>
<td>Peking University, China</td>
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<td>Sciences</td>
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<td>3</td>
<td>Machine Learning</td>
<td>Machine Learning Algorithms: From Math to Code 机器学习算法：从数学到代码</td>
<td>WANG Ruye</td>
<td>Harvey Mudd College, USA</td>
<td>AM</td>
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<td>Algorithms</td>
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<td>Management</td>
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<td>5</td>
<td>Engineering &amp;</td>
<td>Intelligent Manufacturing: Data Science and Process Models 智能制造：数据科学与过程模型</td>
<td>Andrew KUSIAK</td>
<td>The University of Iowa, USA</td>
<td>PM</td>
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<td></td>
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<td>6</td>
<td>Finite Element</td>
<td>Finite Element Modeling for Engineering Applications 工程应用有限元建模</td>
<td>Garth PEARCE</td>
<td>University of New South Wales, Sydney, Australia</td>
<td>PM</td>
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<td></td>
<td>Modeling</td>
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<td>7</td>
<td>Robotics</td>
<td>Robotics: Programming and Practice 机器人入门 : 编程与实践</td>
<td>XIE Guangming</td>
<td>Peking University, China</td>
<td>PM</td>
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<tr>
<td>8</td>
<td>Molecular</td>
<td>Fundamentals and Applications of Molecular Simulations 分子模拟基础与应用</td>
<td>ZHUANG Houlong</td>
<td>Arizona State University, USA</td>
<td>PM</td>
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<td>Simulations</td>
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<td>JIAO Yang</td>
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<td>9</td>
<td>Innovation &amp;</td>
<td>Financial Decisions in Engineering Project Management 工程项目管理中的金融决策</td>
<td>Daricha SUTIVONG</td>
<td>Chulalongkorn University, Thailand</td>
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<td>Entrepreneurship</td>
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<td>10</td>
<td>Energy Economics</td>
<td>Energy Economics and Finance 能源经济学与金融学</td>
<td>Manuel PINHO</td>
<td>Former professor at Columbia, Georgetown and Yale Univ.</td>
<td>AM</td>
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<td>and Finance</td>
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<td>11</td>
<td>Data Driven</td>
<td>Data Driven Techniques for e-Business  电子商务数据驱动技术</td>
<td>SEE-TO Wing Kuen</td>
<td>Lingnan University, HongKong, China</td>
<td>AM</td>
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<td>Techniques for</td>
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<td>12</td>
<td>Social Network</td>
<td>Social Network Analysis 社交网络分析</td>
<td>Ines LINDNER</td>
<td>Vrije Universiteit, Amsterdam, The Netherlands</td>
<td>AM</td>
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<tr>
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<td>Analysis</td>
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<tr>
<td>13</td>
<td>China Past and</td>
<td>China Past and Present 中国的过去与现在</td>
<td>David SENA</td>
<td>Harvard University Trinity College, USA</td>
<td>PM</td>
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<tr>
<td></td>
<td>Present</td>
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<td>Yunchiahn C. SENA</td>
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</table>
Simulation Methods for Optimization and Learning
优化与学习模拟方法

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 paradigms we witness in our societies. While actively working on simulation projects, the course will provide space for reflecting on the technological/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.

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

Grading Format
30% Simulation project I and written report
30% Simulation project II written report
30% Final exam
10% Attendance and discussion
100% Total

Note
1. Students need to bring their own laptops for this course;
2. Material will be provided during the course;
3. Additional recommended reading:
   (2) Chapters 1,2,5,6,7,8,9 of Simulation Modeling and Analysis, A. Law, Mc Graw Hill, 4-th or 5-th edition

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

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.

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

Grading Format
40% Homework assignments
60% Exam (open-book)
100% Total

Textbook

Prerequisites
Calculus (Single variate, and multi-variante), Linear Algebra, Ordinary Differential Equations.
Machine Learning Algorithms: From Math to Code

**Synopsis**

This course covers the most essential topics in machine learning (ML), which is in the very core of artificial intelligence, including statistical and neural network methods for both supervised learning, such as naive Bayes classification, AdaBoost algorithm, support vector machines (SVM), Gaussian process classification (GPC), decision tree learning, perceptron network and back propagation network; and unsupervised learning, such as K-means clustering, expectation maximization (EM), competitive learning network and self-organizing map (SOM). The course also discusses various related issues in data compression and feature selection, including dimension reduction methods such as principal component analysis (PCA). The course also covers some related numerical methods necessary for the various learning algorithms, such as algorithms for solving eigenvalue problems, and for linear and quadratic optimization problems both with and without constraints. The course emphasizes the necessary theories and mathematics behind the various algorithms, discussed in class, as well as the code implementation of such algorithms, carried out as homework assignments by the students in any language such as Matlab (recommended), C++, and python, of the student’s choice.

**Topics**

- **Fundamentals:**
  - Regression Analysis
  - Linear regression, Nonlinear regression, Logistic regression, Softmax regression, Gaussian process regression
  - Classification (Supervised Learning)
  - K nearest neighbors/minimum distance, Naive Bayes classifier, Support vector machine, Classification based on Gaussian process, AdaBoost
  - Clustering (Unsupervised Learning)
  - K-means clustering, Gaussian mixture model, Mixture of Bernolli
  - Neural Networks
  - Artificial neural networks, Hebbian Learning and Hopfield Network, Perceptron Network, Back Propagation, Competitive Learning, Self-Organizing Map
  - Feature Selection and Dimension Reduction
  - Feature section, Principal component analysis (PCA), Kernal PCA, Probabilistic PCA, Classical multidimensional scaling, t-Distributed Stochastic neighbor embedding

- **Notes:** (Certain topics may be reduced or dropped based on the student background)

**Grading Format**

- 25% Homework assignments
- 25% Project assignments
- 50% Final exam
- 100% Total

**Prerequisites**

The student is expected to have gained familiarity with the basic concepts in calculus, linear algebra, and probability, and proficiency in some programming language (Matlab, python, etc.).

**Note**

Students need to bring their own laptops for this course.

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Integrated Water Resources Management: International Aspects

**Synopsis**

The course starts with a quick introduction on water resources and hydrological processes such as precipitation, evaporation, infiltration, soil and groundwater and runoff, and the relations of all these processes with the overall climate. The second part strives to give insight on Integrated Water Resources Management (IWRM) in a global sense with good comprehension of technical and non-technical issues to address the risks of World Water War.

**Topics**

1. Hydrological system, water circulation, water balance
2. Precipitation, rainfall-runoff relationships and evaporation
3. Runoff calculation with hydrograph analysis
4. Urban hydrology and storm water management
5. Hydraulics and flooding risks
6. Soil water and groundwater
7. Climate systems, climate variability and climate change
8. Introduction and fundamentals of IWRM
9. Contents, tools and implementation of IWRM with case examples
10. Water connection to UN’s Sustainable Development Goals (SDGs)
11. Sustainable development and value of water
12. Field visit to relevant sites around Beijing.

**Grading Format**

- 25% Homework assignments
- 25% Project assignments
- 50% Final exam
- 100% Total

**Professor**

Linus ZHANG
Lund University, Sweden
**Finite Element Modeling for Engineering Application**

**Synopsis**

Finite element modeling is a powerful computational method which is the cornerstone of modern design. Amongst other things, it enables accurate prediction of a mechanical behavior of structures enabling prediction of structural integrity through mechanical yield, thermal strain, fracture and fatigue. It is particularly useful in industries such as the aerospace, nuclear and biomedical devices which have high design constraints and where prototype testing is particularly challenging. A new area where finite element modelling is being applied is to understand the behavior of biological tissue such as teeth, bone and human organs, which have unique multiscale design, and the effect of factors such as disease, exercise and damage.

**Topics**

1. Review of the Finite Element Method (FEM) fundamentals:
   - Solid mechanics refresher
   - Mathematical basis for FEM
   - Examples of FEM in engineering applications
2. Basics of Linear and Nonlinear FEM:
   - Creation of simple Finite Elements
   - Element types and their uses
   - Finite Element best practices
3. Advanced FE topics:
   - Thermal analyses
   - Analysis of composite materials
   - Transient and vibration analyses
   - Lightweight structures
   - Buckling analyses
   - Fluid structure interaction and more...

**Grading Format**

50% Group Project
20% Mid-term Exam
30% Final Exam
100% Total

**Prerequisites**

Engineering mathematics (2nd year equivalent), Solid mechanics and materials (2nd year equivalent), Numerical methods (optional but advised).

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**Intelligent Manufacturing: Data Science and Process Models**

**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.

**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

**Grading Format**

20% Homework assignments
20% Quizzes
10% Classroom exercises
30% Project
20% Final exam
100% Total

**Note**

Students need to bring their own laptops for this course.
Robotics: Programming and Practice

Synopsis
This is an introductory course to expose students to the fundamental knowledge and innovative practice of robotics. In the course project, students construct and program a simple robot to interact with its environment and perform basic tasks involving motion, sensory data and decision-making. The course is divided into three parts. The first part is a brief introduction of robotics, including history and current developments. Students carry out experiments with a fish-like robot and a somatosensory control of humanoid robot developed by the in-house team. The second part is concerned with programming practice with various types of hardware for robot, including switch, LED light, buzzer, sensor and actuator. The last part is concerned with robotic design and construction, and innovative application demo. Students are required to build a simple robot aimed at solving some real problems.

Topics
1. Basic knowledge of robotics
2. History of robotics
3. Current development of robotics
4. Fish-like underwater robot
5. Humanoid robot
6. Somatosensory control
7. Graphic programming in Scratch
8. Programming with hardware
9. Robot design and construction
10. Robot application demonstration

Grading Format
40% Programming Practice (Team)
(Project Presentation 20%, Project Report 20%)
50% Final Project Assessment (Team)
(Project Presentation 15%, Class Presentation 15%, Project Report 20%)
10% Attendance & Discussion
100% Total

Note
1. At the end of the course, a robot competition will be held and all students are welcome to participate. The outcome of the competition will not have any bearing on your final grade.
2. Students need to bring their own laptops for this course.

Professor
XIE Guangming
Peking University, China

Fundamentals and Applications of Molecular Simulations:
Monte Carlo, Molecular Dynamics and Density Functional Theory

Synopsis
Computer simulation has become an extremely attractive and necessary tool for the advancement of both our understanding of fundamental material physics and practical material applications. This course will provide the students with an introductory level understanding of the concepts and techniques for the modeling and simulations of materials on atomistic and molecular scales. Both fundamentals and applications of the most popular molecular simulation methods including Monte Carlo (MC) simulations, Molecular Dynamics (MD) methods and Density Functional Theory (DFT) will be discussed, through examples distilled from the frontier of computational materials and soft matter research.

Topics
1. Essence of statistical mechanics and C/C++ programming
2. Fundamentals of Monte-Carlo simulation
3. Monte-Carlo simulations in different ensembles
4. Case study: Phase transitions in colloids
5. Optimization via simulated annealing
6. Fundamentals of molecular dynamics
7. Case study: Self-diffusion in liquid Argon
8. Many-body Schrödinger equation
10. Equilibrium structure of materials: calculations vs. experiment
11. Elastic properties of materials
12. Vibrations of molecules and solids
13. Phonons, vibrational spectroscopy, and thermodynamics
14. Band structures and photoelectron spectroscopy
15. Dielectric function and optical spectra

Grading Format
70% Class project assignments
30% Final project
100% Total

Optional Textbooks
• Daan Frenkel and Berend Smit, Understanding Molecular Simulation (2nd edition).
• Dierk Raabe, Computational Materials Science (available on the author's webpage).
• Feliciano Giustino, Materials Modelling using Density Functional Theory.

Prerequisites
Students taking this course should have some general knowledge of college physics and a background in and working knowledge of a computer programming language (C/ C++/ FORTRAN/ MATLAB). The essence of the C/C++ programming language will be reviewed in class and example codes will be explained so that the course should be accessible to students with minimal programming experience.

Note
Students need to bring their own laptops for this course.
Financial Decisions in Engineering Project Management
工程项目管理中的金融决策

 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 value 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.

TOPICS
1. Time Value of Money, Interest Rate, Economic Equivalence, Simple and Compound Interests
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 FORMAT
25% Quiz 1 (Topic 1-3)
35% Quiz 2 (Topic 4-7)
30% Group Project Presentation and Report
10% Attendance and Participation
100% Total

Energy Economics and Finance
能源经济学与金融学

 SYNOPSIS
The course is an objective introduction to the energy transition. The topics include energy units and conversions, discount rate, energy balances; the energy transition: climate awareness, abundant fossil fuels, super low-cost renewable energies, decentralized generation, new transport models and energy markets. The course includes: a) 8 recitations followed by the presentation and discussion of papers; b) 4 lectures by guests speakers on solar power, electricity storage, EV’s and natural gas; and c) 3 computer-based cases: 1) cost of electricity generation with different technologies; 2) simulation of a world climate deal; and 3) long term scenario for China emissions and energy.

TOPICS
1. Energy units
2. The discount rate in energy and climate economics
3. The driving forces that are changing the world
4. Energy transition
5. Energy balance
6. Oil markets
7. Natural gas markets
8. Power systems
9. Levelized costs of electricity
10. The challenge of renewable energies integration
11. Power system challenges in China
12. Climate science 101
13. International climate negotiations
14. China 2050 simulation
15. Paris COP 21 simulation

GRADING FORMAT
25% Class attendance and participation
25% Short paper
25% Class presentation
25% Final exam
100% Total

NOTE
Students should bring their laptop to the class. A set of papers will be distributed on the 1st day of classes.
Data Driven Techniques for e-Business
电子商务数据驱动技术

Synopsis
This course introduces the fundamentals of data driven techniques for e-business. Students will learn from this course the essential techniques for e-business organizations to make use of the now available big data streams about their customers. Big data has emerged as critical source of competitive advantage for e-business, and as a system of knowledge that is already changing the objects of knowledge and promises to bring new insights to our understanding of human networks and communities. Data driven techniques provide the ability to gain insight from such large scale, and fast changing data streams derived from phenomena where the underlying objects of interest are related in a complex manner. In the digital world, our every browse, every click, every review we read and write, every purchase we make, and so much more are all stored in the databases of relevant organizations. Leveraging from this digital archive, organizations use data driven techniques to learn about us, and to provide us with ever smarter and better experience. This course aims at familiarizing students with the latest developments and innovations in this fast-growing area of data driven techniques in e-business, and equipping them with relevant knowledge and skills for the corresponding real life applications.

Topics
1. Analytics for Recommendation Systems
2. Customer Lifetime Value Modelling
3. Customer Retention-Churn Model
4. Fraud Detection
5. Natural Language Processing (NLP) Models for User Generated Content (UGC) analysis
6. Storytelling with Data: Visualization of Large and Complex Datasets

Grading Format
40% Midterm Project
60% Final Project
(Project Presentation 30%, Project Report 30%)
100% Total

Note
Students need to bring their own laptops for this course.

Social Network Analysis
社交网络分析

Synopsis
Social Network Analysis discusses the complex “connectedness” of social (and economic) relationships which is found in numerous incarnations: the rapid growth of the world-wide-web, the ease with which communication takes place, the fast spread of news and information as well as its impact on opinion formation and our society. We start with an analytical toolbox of recognizing and analyzing patterns of social network data. These tools show how to simplify complexity such as (1) global patterns (degree distributions, path lengths and the small world phenomenon, decomposition of networks), (2) segregation patterns (node types and homophily), (3) local patterns (clustering, transitivity, support) as well as (4) positions in networks (neighborhoods, centrality, influence measures). Next, we will discuss research on network formation and analyze how different model assumptions leave their characteristic footprint on network data. We discuss a large class of (growing) random networks models which explains a plethora of phenomena (rich-get-richer, small world, social media communication graphs). This class also serves as an important benchmark for identifying non-random properties of networks in which links are formed strategically (business relationships, co-author models). Hybrid models lie in between these two complementary approaches and are able to explain a large class of data (islands-connections model). Finally, we will discuss dynamic implications of the network structure in the context of (1) diffusion through networks (spread of information and diseases, financial contagion) as well as (2) learning and consensus formation on networks (imitation and social influence, wisdom of crowds). Key issues for both classes of dynamics are identifying key actors and their impact on aggregate behavior and beliefs. In particular, these methods allow to analyze the value of individuals in a collectivity (value a of member for team performance).

Topics
1. Fundamental quantitative concepts of Social Network Analysis.
2. Classification of Social Network Data in terms of structural properties.
3. Social network formation
4. Policy implications in order to optimize social network processes
5. Setting up mathematical models in order to explain a phenomenon in social network dynamics

Grading Format
20% Quizzes in class
30% Research proposal about network topic
40% Final exam
10% Attendance and discussion
100% Total

Note
1. Students need to bring their own laptops for this course;
2. Material will be provided during the course;
China Past and Present
中国的过去与现在

Synopsis
China today is a land of diversity, characterized by striking variations in its geography, economy, and ethnicity. Yet underlying this diversity is a shared cultural heritage from its past: a unifying set of historical, literary, and artistic traditions, built upon essential philosophical ideals, political institutions, and a common writing system. This course introduces the study of China through an examination of social and cultural unities and diversities that comprise the historical development of Chinese civilization and set the foundation for China in the present day. Course topics include issues in philosophy, religion, literature, art, science, gender, ethnicity, and cultural identity. This course provides a framework for the understanding of Chinese history, society, art and culture. The class activities include lecture, discussion, and a visit to the National Museum of China, Beijing.

Topics
Part I. Chinese History and Society
1. An Overview
   • Land and climate
   • Languages and writing
   • Origins of Chinese civilization
2. Early Ideals and Practices
   • Mandate of Heaven and the dynastic state
   • Classical Chinese thought
   • Chinese imperial system
3. Later Development
   • China at the end of the Silk Road
   • Commercial revolution
   • Late Imperial China
4. Challenges in Modern Times
   • Imperialism in China
   • China in revolution
   • China under Mao
   • China in the Post-Mao period
Part II. Chinese Culture and Art
5. Ritual Art in Early China
   • Ancestor worship in the Shang-Zhou period
   • Funerary Art in the Qin-Han period
   • Elite Culture in the Wei-Jin period
6. Pan-Asian Culture and the Silk Road
   • Early Buddhist art in the Northern Dynasties
   • Courtly culture in the Tang period
   • Urban architecture in Tang Chang’ an
7. Literati Culture and Neo-Confucianism
   • Representing nature in the Song-Jin period
   • Reflecting antiquity in the Yuan-Ming period
   • Courtesan culture in the Jiangnan region
8. China in the Global Market
   • Market art in the Ming-Qing period
   • Modern and Contemporary Chinese art

Grading Format
15% Class participation
15% Group presentation
15% Short essay
25% Midterm exam
30% Final exam
100% Total

Textbook
### Program Expenses

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost USD (CNY) (USD 1=CNY 7)</th>
<th>Estimated Expenses for a 1-Month Stay in Beijing (pro-rate your expenses if your stay is less than 31 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Registration Fee</td>
<td>43 (300)</td>
<td>Compulsory Registration Fee for All Applicants</td>
</tr>
<tr>
<td>Accommodation</td>
<td>31-Day Stay</td>
<td>1. <strong>Beijing Post &amp; Telecom Conference Center</strong> &lt;br&gt;Type A - Standard Double Occupancy: CNY 110/day &lt;br&gt;Type B – Superior Double Occupancy: CNY 210/day &lt;br&gt;2. <strong>Beijing Yanshan Hotel</strong> &lt;br&gt;Type C – Superior Double Occupancy: CNY 250/day &lt;br&gt;3. <strong>Ariva Beijing West Hotel &amp; Serviced Apartment</strong> &lt;br&gt;Type D - Loft Double Occupancy: CNY 275/day</td>
</tr>
<tr>
<td>Meals</td>
<td>220 (1550)</td>
<td>CNY 50/day X 31 days (meals at PKU cafeterias).</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>220 (1550)</td>
<td>Personal Items, transportation etc.</td>
</tr>
<tr>
<td><strong>BASIC TOTAL</strong></td>
<td>970-1700 (6810-11925)</td>
<td>Recommended minimum expenses are estimates, your actual cost may be different. Airfare not included</td>
</tr>
<tr>
<td>Globex Tuition</td>
<td>0-1710 (0-12,000)</td>
<td>1. Full Waiver (you may still need to pay tuition to your school) &lt;br&gt;2. Partial Subsidy &lt;br&gt;3. Full Cost Recovery</td>
</tr>
<tr>
<td>Field Trip &amp; Tour (Optional)</td>
<td>USD 140 (980)</td>
<td>3-day Pre-Globex Beijing Tour including the Great Wall, Forbidden City, Summer Palace etc.</td>
</tr>
<tr>
<td></td>
<td>USD 400-450 (2800-3150)</td>
<td>After-Globex tours (round-trip sleeping berth/high-speed train): &lt;br&gt;1. Xi’an TerraCotta Warriors, Huaqing Palace, Qianling, Ming City Wall (5 days, USD 450) &lt;br&gt;2. Hangzhou-Suzhou-Wuzhen-Shanghai (5 days, USD 430) &lt;br&gt;3. Taishan Mountain-Qufu Confucius Temple-Jinan (3 days, USD 400)</td>
</tr>
</tbody>
</table>

### Miscellaneous Info: Credit Transfer, Chinese Visa, Health Insurance, etc.

- 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.
- Globex will provide the necessary documents for applicants to apply for their Chinese visas.
- It is mandatory for all Globex students to process a valid medical insurance during their stay in China.
- More detailed information is available at [http://globex.coe.pku.edu.cn](http://globex.coe.pku.edu.cn).