THE GLOBEX PROGRAM IN ENGINEERING @ PEKING UNIVERSITY

The Global Educational Exchange (Globex) program constitutes an initiative for educational exchange and research collaboration between The College of Engineering at Peking University, Beijing, China and a foreign College of Engineering. It is designed to deepen the growing partnership between the two institutions by providing a framework for exceptional students and faculty to attain a global educational, research and professional experience. Both parties subscribe to the policy of equal opportunity and non-discrimination on the basis of race, sex, age, ethnicity, religion or sexual orientation. The Globex agreement is governed by the principles of equality, reciprocity and mutual benefit.

Globex 是北京大学工学院和多所世界知名大学工学院之间达成的关于学生交换学习和合作研究的项目。此项目旨在加深北大工学院与其他多所世界著名大学工学院之间的合作关系，为优秀的工科学生和教师提供一个很好的全球教育交流和研究交流的实践平台。目前北大工学院与多所知名大学均已经达成共识，即 Globex 协议在机会均等以及在种族，性别，年龄，名族，宗教，性取向的非歧视政策基础上采用平等和互惠互利原则。

The table below depicts the 4 Globex programs together with the 12 university participants.

Globex 项目有 4 种形式，共有 12 所高校参加，如下详情。

2012-2013 Globex Participants

University	Participants	2012 Globex Summer	2012 Globex Fall	2013 Globex Spring	2012-2013 Globex Design
Peking University	Instructor & Students	√	√	√	√
University of Delaware	Instructors & 6 Students	√	√		
Stanford University	Instructors & 10 Students	√			
University of Maryland	Instructor & 15 Students	√	√		
University of Toronto	Up to 5 Students	√	√		√
Tsinghua University	Up to 15 Students	√			
Yokohama National University	Up to 5 Students	√			
Chinese University of Hong Kong	Up to 5 Students	√			
CONICYT (4 Chilean Universities)	Up to 15 Students	√			
National University of Singapore	TBD				√
University of Southern California	TBD			√	
Princeton University	TBD			√	

PKU ENGINEERING

Peking University College of Engineering

Peking University College of Engineering was established in 1910. However, in 1952 most engineering programs were relocated to Tsinghua University. Today, with the rapidly advancing economic and socio-technological developments in the Chinese economy and Chinese Society, coupled with the goal of Peking University to become a World class university, The College of Engineering was officially re-established in March 2005. The focus of PKU Engineering is on cutting-edge technologies, interdisciplinary research and the training of future engineering leaders and entrepreneurs. Since its rebirth, the College has made significant progress in faculty recruitment, scientific research and research collaborations, educational achievements, and global programs and relationships. The College currently has 6 departments and 18 research centers, 3 of which are state key research institutes. Many of them are recognized internationally for their research excellence. The College is rapidly evolving into one of the elite engineering schools recognized throughout the World. Since 2009 PKU Engineering has been consistently ranked in the top 50 worldwide and second in China by both US News and World Report and the UK Times Higher Education.

Contact Info

Dean's Office

Dean of Engineering: Shiyi Chen

Executive Vice-Dean: Dongxiao Zhang

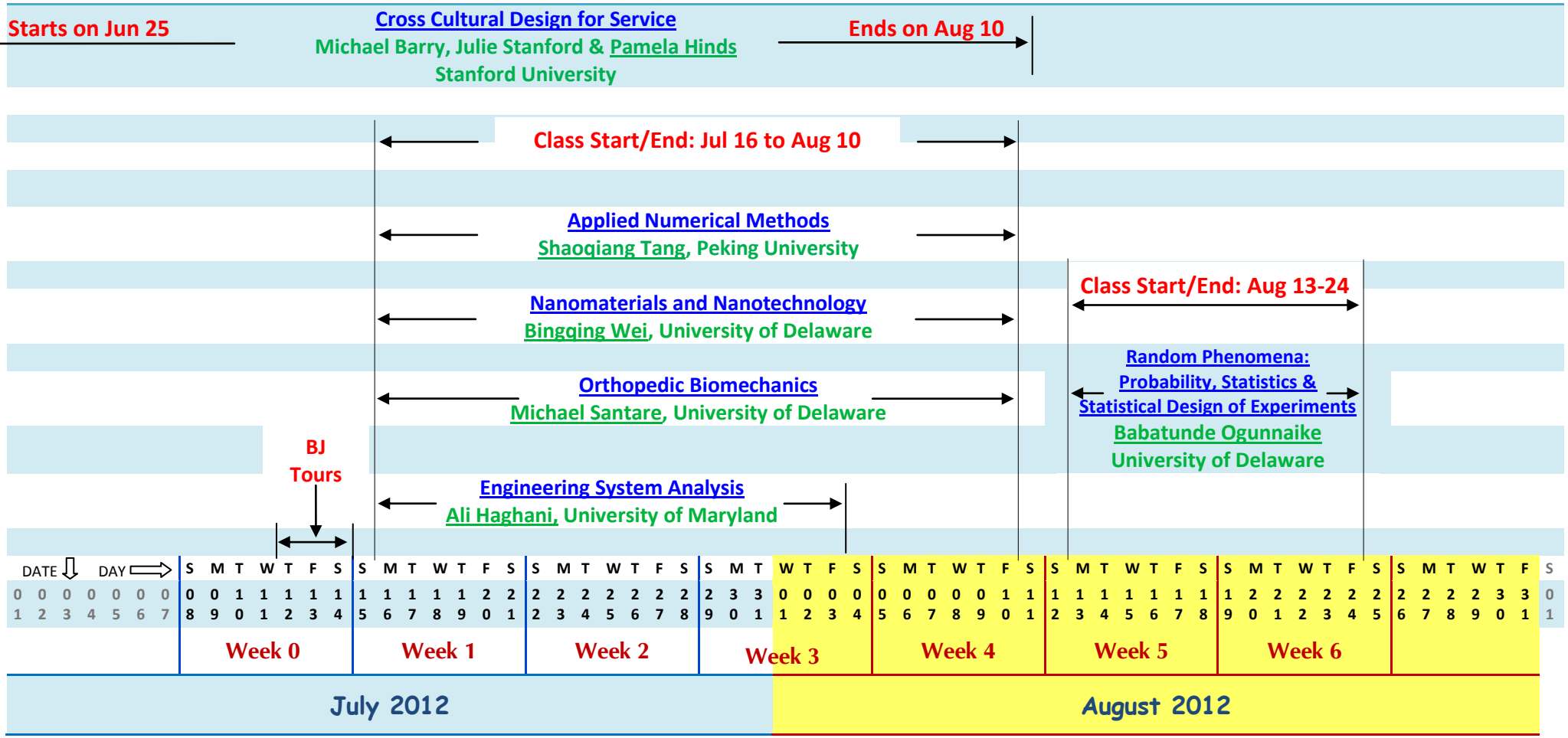
Globex Program Office

Assistant Dean: Han Pingchou (ray-han@pku.edu.cn & 8610-6276-7394)

Administrative Officer: Michelle Ning Liu (globex@coe.pku.edu.cn & 8610-6275-6184)

College Website: http://www.coe.pku.edu.cn/

2012 Globex Summer @PKU, Beijing



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PKU and YNU students showing off their lighter side after completing all their presentations

Top & Bottom: PKU and Stanford students taking a break on the last day of workshop

PKU welcoming University of Pittsburgh students

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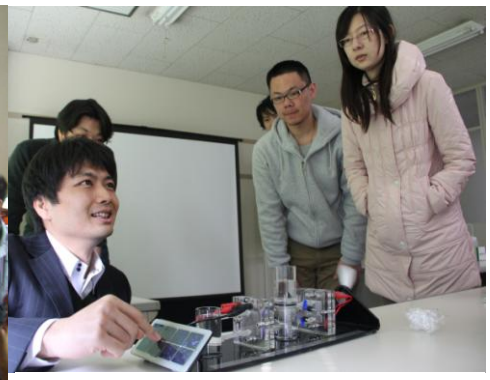
Globex Design Program

Over the past several years, PKU-COE has initiated joint design programs with Stanford University, National University of Singapore and the University of Toronto. Adopting a *cross-cultural* approach, students work collaboratively in teams of four (2 PKU and 2 foreign students) on industry-sourced projects. Some of the sponsoring companies included Schlumberger, Schneider Electric, Apple, Goggle, Panasonic, Wrigley Gums, Boeing, Siemens, Intel, Proctor & Gamble, American Heart Association, Hermann Miller, and several more.

PKU presentations at the University of Toronto, Canada
March 19, 2011

PKU-NUS Team for the badminton shuttlecock launcher project

PKU-Stanford students deeply engrossed in their project discussions



YNU's Araki demonstrates a working model of a fuel cell

PKU girls by the Niagara

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The 2010 Cross-Cultural Design Project Teams

(PKU, Stanford, CAFA Students)

Team Nokia Education

Team American Heart Association

Team Wrigley

Team Nokia Family

Team Intel

Team Herman Miller Healthcare

2012 Globex Summer Instructors

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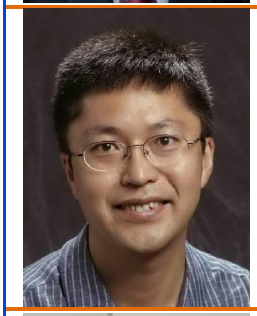
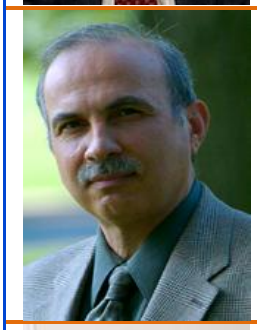
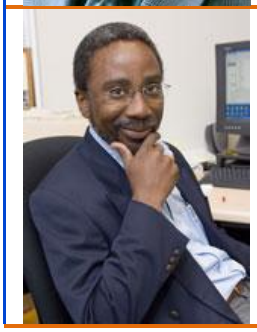
	Cross Cultural Design for Service 跨文化服务设计 **Pamela Hines** **Associate Professor** **Stanford University**	No. of Credits: 3 Duration: Jun 25 – Aug 10 Frequency: Varies Further Info: See Page 8
	Applied Numerical Methods 数值方法 **Shaoqiang Tang** **Professor and Associate Dean** **Peking University**	No. of Credits: 3 Duration: Jul 16 – Aug 10 Frequency: 8-10 AM, M-F Further Info: See Page 9
	**Nanomaterials and Nanotechnology** 纳米材料与纳米技术 **Wei Bingqing** **Professor** **University of Delaware**	No. of Credits: 3 Duration: Jul 16 – Aug 10 Frequency: 10 AM-12 PM, M-F Further Info: See Page 10
	Orthopaedic Biomechanics 骨科生物力学 **Michael H. Santare** **Professor** **University of Delaware**	No. of Credits: 3 Duration: Jul 16 – Aug 10 Frequency: 1-3 PM, M-F Further Info: See Page 11
	**Engineering Systems Analysis** 工程系统分析 **Ali Haghani** **Professor and CEE Dept Chair** **University of Maryland**	No. of Credits: 3 Duration: Jul 16 – Aug 03 Frequency: 3-6 PM, M-F Further Info: See Page 12
	**Random Phenomena: Probability, Statistics and Statistical Design of Experiments** 随机现象：概率、统计和统计实验设计 **Babatunde A. Ogunnaike** **Professor and COE Dean** **Member, National Academy of Engineering** **University of Delaware**	No. of Credits: 3 Duration: Aug 13 – Aug 24 Frequency: 10-12 AM, 1-3 PM, M-F Further Info: See Page 13

Cross Cultural Design for Service (3 Credits)

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跨文化服务设计

Instructors: Julie Stanford (julie@slicedbreaddesign.com), Michael Barry (mbarry@pointforward.com) & Pamela Hinds (phinds@stanford.edu), The Design School, Stanford University

Description: The Cross Cultural Design for Service (CCDS) course aims to teach design process and apply design thinking to service projects in rural China. This innovative class will be taught in a cross-culture environment. The class will be formed with 10 SU students, 5 PKU students, and 5 Tsinghua students. The course is consisted of a one-week design thinking workshop in PKU, 5-week design projects in a rural area of China, and a wrap-up session in Beijing.

Class Frequency & Dates: **See Table Below,** Jun 25 – Aug 10, 2012

Course Location: Peking University, Beijing and Mianyang, Sichuan

Office Hours: TBA

Class Location	Class Dates	Hotel Checkin / Checkout Dates
PKU, Beijing	Jun 25 – Jul 1	Jun 24 / Jul 2
Mianyang, Sichuan	Jul 4 – Aug 3	Jul 3 / Aug 4
PKU, Beijing	Aug 4 – Aug 10	Aug 4 / Aug 11

Objective

To develop an understanding of the design process and applying design thinking to service projects.

Text/References

TBD

Syllabus

Developing Empathy
- Conducting Interviews
- Learning from Observations

Developing Insights
- Data Analysis
- Tools for Revealing Insights

Ideation
- Techniques for Generating Ideas
- Brainstorming
- Concept Generation

Prototyping
- Reasons for Prototyping
- What can be learned from Prototyping
- Creating Rapid Prototypes

Testing and Iterating
- Getting Input from Users

Project Deliverables

The deliverables consist of project presentations and design. The schedule for presentations is as follows.

Week 3	Project presentation on developing empathy and insights
Week 4	Project presentation on concept generation
Week 5	Project presentation on prototyping
Week 7	Journal submission final presentation and design

Grading

Interim Project Presentations	15%
Final Project Presentations	50%
Design Journal	15%
Teamwork and Citizenship	20%
Total	100%

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Applied Numerical Methods (3 Credits)

数值方法

Instructor: Shaoqiang Tang, Dept of Mechanics, Peking University (maotang@pku.edu.cn)

Description: A course on the basic computational tools for generating numerical solutions. Included are methods for the solution of algebraic equations, linear equations, ordinary and partial differential equations and curve fitting techniques.

Prerequisite: Calculus, Linear Algebra, Matlab or other computer languages

Class Frequency & Dates: **8-10 AM, M-F,** Jul 16 – Aug 10, 2012

Course Location: Peking University, Beijing, China

Office Hours: TBA

Objectives: To develop basic computational and modeling skills for solving mathematical problems arising from physical sciences and engineering; and to enhance the understanding of the relationship between continuous and discrete mathematics.

Topics:	1. Introduction to computing: numerical errors, recap of Matlab
	2. Roots of equations: bracketing, Newton's method
	3. Linear algebraic equation systems: Gauss elimination, LU decomposition, matrix inversion, iteration methods
	4. Curve fitting: least square regression, interpolation
	5. Numerical differentiation and integration
	6. ODE: Euler's method, Runge-Kutta method, stiff systems, boundary value problems
	7. PDE: IVP, BVP & IBVP, finite difference method

References:

1. Chapra, 2005. Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw Hill.
2. Gerald CF, and Wheatley PO 2004. Applied Numerical Analysis, 7th edition. Addison-Wesley. (There is a China-edition published by Higher Education Press, Beijing 2005).

Grading		
	Homework	30%
	Midterm	30%
	Final	40%
	Total	**100%**

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Nanomaterials and Nanotechnology (3 Credits)

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纳米材料与纳米技术

Instructor: Bingqing Wei, Mech Eng Dept, University of Delaware (weib@udel.edu)

Description: Advanced topics in nanoscience and nanotechnology including nanostructures, nanomaterial synthesis, properties, characterizations, and applications. The emphasis will be to introduce students to the science of the building blocks of nanostructured materials, material behavior when they are assembled, technology for building nanoscale structures and features, nanomaterials for energy conversion and storage, and the technological implications of these nanomaterials and nanotechnologies.

Class Frequency & Dates: **10 AM-12 PM, M-F,** Jul 16 – Aug 10, 2012

Course Location: Peking University, Beijing, China

Office Hours: TBA

Objective To develop an understanding of the material and system characteristics and responses at the nanoscale level, in order to have a better grasp of the nanoscience and nanotechnology governing their novel and significantly improved physical, optical, chemical and biological properties.

Topics

1. Introduction
2. Science of Building Blocks: Nanoparticles and Quantum Dots
3. Nanotubes, Nanorods and Nanowires
4. Nanocomposites
5. Processing-Structure-Property Correlations in Nanostructured Materials: bottom-up and top-down processing techniques, microstructural features and mechanical, physical and chemical properties
6. Advanced Characterization Techniques for Nanostructured Materials
7. Energy Conversion and Storage in Nanostructured Materials
8. Nano to Molecular Electronics
9. Bio-inspired and Bio-applications of Nanostructures and Nanomaterials
10. Applications of Nanostructured Materials

References

1) Massimiliano Di Ventra, Stephane Evoy and James R. Heflin, Jr., *Introduction to Nanoscale Science and Technology*, Springer
2) Gregory Timp, *Nanotechnology*, Springer-Verlag
3) Charles P. Poole, Jr., and Frank J. Owens, *Introduction to Nanotechnology*, John Wiley & Sons
4) Pulickel M. Ajayan, Linda S. Schadler, and Paul V. Braun, *Nanocomposites Science and Technology*, John Wiley & Sons
5) M. S. Dresselhaus, G. Dresselhaus, P. Avouris, *Carbon Nanotubes : Synthesis, Structure, Properties, and Applications*, Springer-Verlag
6) *Journal Papers*

Grading

Midterm Project Assessment	
Class Presentation	25%
Term Paper	20%
Final Project Assessment	
Class Presentation	25%
Term Paper	20%
Attendance & Discussion	10%
Total	**100%**

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Orthopaedic Biomechanics (3 Credits)

骨科生物力学

Instructor: Michael H. Santare, Mech Eng Dept, University of Delaware (santare@udel.edu)

Description: Anatomy and physiology including microanatomy and mechanics of bone, cartilage, tendon and muscle. Mechanical modeling of the body including; joint loads, motion analysis, muscle forces and interactions with orthopaedic devices.

Class Frequency & Dates: **1-3 PM, M-F,** Jul 16 – Aug 10, 2012

Course Location: Peking University, Beijing, China

Office Hours: TBA

Objective To develop an understanding of the mechanics of the human musculoskeletal system and to establish facility with techniques for modeling this system.

Text Bartel, Davy, Keaveny, Pearson, *Orthopaedic Biomechanics*, Prentice Hall, 2006.

Syllabus

Gross Anatomy
- Terminology
- Bones
- Muscles
- Joints

Tissues and Structures
- Bones
- Connective Tissues
- Muscles

Mechanical Joint Analysis
- Kinematics of Joints
- Kinetics of Joints
- Muscle Redundancy

Applied Biomechanics
- Implants and Devices
- Motion Analysis

Project Overview

The project consists of a research paper and analysis on a mechanism of soft tissue injury. Students are to work in teams of two. The work should be evenly divided and team members will receive the same project grade. All papers should provide a review of the current literature and results of a force or motion analysis of the particular injury mechanism under review. Topics must be approved by the instructor. Each team will submit a written report (less than 10 pages).

	Injury Mechanism Analysis of	
Sample Project Topics	Cervical disc rupture	Rotator cuff tear
	Lumbar disc herniation	Shoulder separation
	Anterior cruciate ligament rupture	Shoulder dislocation
	Knee meniscus tear	Supraspinatus impingement
	Chondromalacia	Tendinosis in the ….
Project Deadlines	Topic Selection	First week
	Bibliography	Second Week
	Draft paper and Preliminary Model	Fourth Week
	Completed Paper and Analysis	Fifth Week

Grading

Midterm	25%
Final	30%
Project	25%
Homework	20%
Total	**100%**

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Engineering System Analysis (3 Credits)
工程系统分析

Instructor: Ali Haghani, Civil & Environ Eng Dept, University of Maryland (haghani@umd.edu)

Description: This course introduces advanced undergraduate engineering students to systems analysis, modeling, optimization, and the quantitative techniques that are used in problem solving and decision making. The following major topics are covered in this course: deterministic modeling and optimization, linear programming, integer programming and dynamic programming.

Class Frequency & Dates: **3-6 PM, M-F,** Jul 16 – Aug 03, 2012

Course Location: Peking University, Beijing, China

Office Hours: TBA

Objective To teach students the concepts of systems analysis and mathematical modeling. The students will learn to develop and solve engineering optimization models using linear and integer Programming. They also learn to work with their peers in teams.

Topics

1. Systems and Systems Analysis
2. Modeling and Optimization
3. Linear Programming, Graphical Solution, Simplex Algorithm
4. Network Problems
5. Integer Programming, Formulation and Solution
6. Dynamic Programming

References

1. ReVelle, C.S., E.E. Whitlatch, and J.R. Wright, 2004, "Civil and Environmental Systems Engineering," 2nd Edition, Pearson Prentice Hall.

Grading

Homework	20%
Midterm Exam	40%
Final Exam	40%
Total	100%

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Random Phenomena: Probability, Statistics and Statistical Design of Experiments (3 Credits)

随机现象：概率、统计和统计实验设计

Instructor: Babatunde A. Ogunnaike, Chem Eng Dept, University of Delaware (ogunnaik@udel.edu)

Description: Fundamental approach to modeling, characterization and analysis of random phenomena with the aim of providing students with the basic principles, methods and tools for solving engineering problems involving randomly varying phenomena. Application areas explored include experimental design, manufacturing, system reliability, and cellular biology.

Class Frequency & Dates: **10-12 AM, 1-3 PM, M-F,** Aug 13–24, 2012

Course Location: Peking University, Beijing, China

Office Hours: TBA

Course Objective To develop an understanding of the basic principles, methods and tools for solving engineering problems involving randomly varying phenomena.

Textbook / Reference Babatunde A. Ogunnaike, *Random Phenomena: Fundamentals of Probability & Statistics for Engineers*, CRC Press, (2009) (*Indicated chapter references are from this book*).

Course Content

Lecture 1	Introduction and Motivation	Chapter 1
Lecture 2	Basic Principles of Random Phenomena Analysis	Chapter 2
Lecture 3	Introductory Concepts of Probability	Chapters 3, 4
Lecture 4	Random Variables and Distributions	Chapter 4
Lecture 5	Multidimensional Random Variables and Distributions	Chapter 5
Lecture 6	Probability Models (Discrete Random Variables)	Chapter 8
Lecture 7	Probability Models (Continuous Random Variables)	Chapter 9
Lecture 8	Case Studies (Mendel, Naval Tactics & IVF)	Chapters 7, 11
Lecture 9	Tutorial and Practical Demonstration ("Lab") Session I	
Lecture 10	Introduction to Statistics & Data Analysis	Chapter 12
Lecture 11	Overview of Sampling Theory and Estimation	Chapters 13, 14
Lecture 12	Overview of Sampling Theory and Estimation	Chapters 13, 14
Lecture 13	Hypothesis Testing	Chapter 15
Lecture 14	Hypothesis Testing & Practical Demonstration ("Lab") Session II	Chapter 15
Lecture 15	Midterm Exam	Chapter 15
Lecture 16	Introduction to ANOVA & Design of Experiment Concepts	Chapter 19
Lecture 17	Single Factor Experiments	Chapter 19
Lecture 18	Multi-Factor Experiments	Chapter 19
Lecture 19	2^k Factorial Experiments	Chapter 19
Lecture 20	Screening Designs I	Chapter 19
Lecture 21	Screening Designs II	Chapter 19
Lecture 22	Response Surface Methodology	Chapter 19
Lecture 23	Response Surface Methodology	Chapter 19
Lecture 24	Presentation of Capstone Project	
Lectures 25-27	Capstone Project Design, Implementation, Execution and Confirmation	
Lectures 28-29	Capstone Project Evaluation	
Lecture 30	Course Summary and Wrap Up	

Grading

Homework: 3 @ 10 pts	30%
Midterm Exam	30%
Final Project	40%
Total	**100%**

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